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FOOD TECHNOLOGY ABSTRACTS

Vol. 29 No. 9
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FOOD
TECHNOLOGY
ABSTRACTS

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ABBREVIATIONS

A	ampere
AAS	atomic absorption spectrometry
ADP	adenosine diphosphate
Anon.	Anonymous
AOAC	Association of Official Analytical Chemists
approx.	approximately
atm	atmosphere
ATP	adenosine triphosphate
a_w	water activity
BHA	butylated hydroxyanisole
BHT	butylated hydroxytoluene
b.p.	boiling point
Btu	British thermal unit
c-	centi- [as in cm, cm^2, cm^3]
cal	calorie
cd	candela
°C	degree centigrade
Ci	curie
CMC	carboxymethyl cellulose
coeff.	coefficient
conc.	concentrated
concn.	concentration
cv.	cultivar
cwt	hundredweight
d-	deci-
DE	dextrose equivalent
detn.	determination
DFD	dark firm dry
diam.	diameter
dil.	dilute
DM	dry matter
DNA	deoxyribonucleic acid(s)
dyn	dyne
E.	East, Eastern, etc
ECD.	electron capture detection
EDTA	ethylenediaminetetraacetic acid
Eh	oxidation-reduction potential
ELISA	enzyme-linked immunosorbent assay
f-	femto-[10^{-15}, as in fCi]
°F	degree Fahrenheit
FAO	Food and Agricultural Organization
FDA	Food and Drug Administration
FID	flame ionization detection
fl oz	fluid ounce
f.p.	freezing point
ft	foot, feet
g	gram
GC	gas chromatography
gr	gravity
gal	gallon
gf	gram-force
GLC	gas-liquid chromatography
h	hour
ha	hectare
HDPE	high density polyethylene
hl	hectolitre [100 l]
hp	horse power
HPLC	high performance/pressure liquid chromatography
HTST	high temperature short time
Hz	hertz [frequency cycles/s]
in	inch
IR	infrared
IU	international unit
J	joule
k-	kilo- [as in kcalk, kg]
K	Kelvin
l	litre
lb	pound
lbf	pound-force
LDPE	low density polyethylene
m-	milli- [as in mg, ml, mm]
m-	equivmilli-equivalent
M	molar concentration
M-	mega- [as in Mrad]
max.	maximum
min	minute [time]
min.	minimum
mol	mole
mol.wt.	molecular weight
m.p.	melting point
MPN	most probable number
MS	mass-spectrometry
n-	nano-[10^{-9}, as in nm]
N	Newton [kg m/s^2]
N.	North, Northern, etc
N	Normal concentration
NMR	nuclear magnetic resonance
NPU	net protein utilization
oz	ounce
p-	pico- [10^{-12}, as in pCi]
P	Poise
p	probability
Pa	pascal (N/M^2)
PAGE	polyacrylamide gel electrophoresis
PER	protein efficiency ratio
p.p.b.	parts per billion
p.p.m.	parts per million
PSE	pale soft exudative
PTFE	polytetrafluorethylene
PVC	polyvinyl chloride
PVDC	polyvinylidene chloride
qt	quart
R	rontgen
rad	rad or radian
ref.	reference(s)
rev/min	revolutions per minute
RH	relative humidity
RNA	ribonucleic acid(s)
S.	South, Southern, etc.
s.d.	standard deviation
SDS	sodium dodecylsulphate
s.e.	standard error
s	second [time]
SNF	solids-not-fat
sp., spp.	species
sp.gr.	specific gravity
summ.	summary
Suppl.	Supplement
t	metric tonne
temp.	temperature
TLC	thin layer chromatography
TS	total solids
UHT	ultra-high temperature
UV	ultraviolet
V	volt
var.	variety
vol.	volume
v/v	volume/volume
W	watt
W.	West, Western, etc.
WHO	World Health Organization
w/v	weight/volume
wk	week
wt.	weight
yd	yard
yr	year
µ	micro-[as in g, µm]
%	per centum
>	greater than
≥	greater than or equal to; not less than
<	less than
≤	less than or equal to; not greater than

ABBREVIATIONS FOR LANGUAGES

Language of text	
Dutch	Nl
French	Fr
German	De
Italian	It
Japanese	Ja
Norwegian	No
Spanish	E
Swedish	Sv

1630

Puri (VM) and Anantheswaran (RC). **The finite-element method in food processing: a review.** *Journal of Food Engineering* 19(3); 1993; 247-274

The finite-element method (FEM) has been used to model several food processing operations. Applications of FEM to solve problems in food processing are discussed; use of FEM in other areas of food processing are also outlined. Specific aspects covered include: heating (for drying) and cooling (for aeration); freezing and thawing; heat and mass transfer; and mechanical damage. Other potential uses of FEM discussed include: baking; extrusion; aseptic processing; microwave heating; and optimization of food quality in terms of texture, nutrient retention and microbial degradation during thermal processing. BV

1631

Bengtsson (E), Traegardh (G) and Hallstroem (B). **Concentration polarization during the enrichment of aroma compounds from a water solution by pervaporation.** *Journal of Food Engineering* 19(4); 1993; 399-407

Pervaporation is a useful technique for recovery and enrichment of aroma compounds from very dilute solutions. To study mass transfer, a 0.5 p.p.m. solution of butyl butyrate, an important aroma compound present in, for example, apple juice, was pervaporated at different circulation velocities along a PDMS (polydimethylsiloxane) membrane. Permeation of butyl butyrate increased with increasing Reynolds number, demonstrating an influence of concentration polarization. To minimize the effect of the polarized layer and to improve mass transfer, optimization of the feed-circulation velocity is important. AA

FOOD PACKAGING

Nil

1632

Califano (AN) and Zaritzky (NE). **A numerical method for simulating heat transfer in heterogeneous and irregularly shaped foodstuffs.** *Journal of Food Process Engineering* 16(3); 1993; 159-171

Heat conduction during cooking of foodstuffs with heterogeneous thermal properties was simulated, mainly for irregularly shaped geometries. A code employing boundary-fitted grids was implemented in a numerically conservative form (control vol. formulation). This technique consists of finding a numerical coordinate transformation which fits a regular grid to the domain of integration. With the grid as data, coeff. for a transformed differential equation are then obtained. The proposed model was experimentally verified on irregularly shaped pieces of beef containing a nonuniform distribution of fat. Relative errors between predicted and measured temp. were less than 2%. Effects of heat transfer coeff. and temp. of the cooking medium on temp. distribution during the process were analysed. Influence of different fat patterns was also considered. AA

1633

Awuah (GB), Ramaswamy (HS) and Simpson (BK). **Surface heat transfer coefficients associated with heating of food particles in CMC solutions.** *Journal of Food Process Engineering* 16(1); 1993; 39-57

The fluid-to-particle heat transfer coeff. (hfp) associated with the heating of cylindrical specimens of potato and carrot were evaluated in carboxymethylcellulose (CMC) solutions (0-1%) at 50-80°C. Average hfp values ranged from 80 to 450 W/m^2C for potatoes and 100 to 550 W/m^2C for carrots. Temp. and concn. of CMC influenced its power law parameters and hence hfp values, while fluid velocity (0.2 to 0.7 x 10^{-3} m/s), sample size (0.016-0.023 m diam., 0.02-0.04 m length) and flow direction (upward and downward) had marginal effects. Natural convection dominated the flow regime, giving good correlations between Nusselt and Rayleigh numbers. AA

1634

Peleg (M). **Assessment of a semi-empirical four parameter general model for sigmoid moisture sorption isotherms.** *Journal of Food Process Engineering* 16(1); 1993; 21-37

Published sigmoid moisture sorption isotherms ($0 < a_w <$ approx. 0.9) were fitted by the 4 parameter models $m = k_{1aw}n_1 + k_{2aw}n_2$ where m is the moisture content (dry basis), a_w the water activity and the k and n values are constants ($n_1 < 1$ and $n_2 > 1$). The model had the same or better fit than the GAB model. In contrast with both the BET and GAB models, the proposed model is not based on the assumption that there exists a well-defined monolayer of absorbed water. At $a_w <$ approx. 0.4 and $n_1 >$ approx. 0.35, however, the model produces a practically linear $a_w/[m(1-a_w])$ vs. aw plot, of the kind used to calculate the monolayer moisture with the BET model. The proposed model can be a convenient means to catalogue both sigmoid and nonsigmoid isotherms, and can be used to calculate equilibrium aw of dry [food] mixtures with equation solving software. AA

1635

Nasri (H), Simpson (R), Bouzas (J) and Torres (JA). **An unsteady-state method to determine kinetic parameters for heat inactivation of quality factors: conduction-heated foods.** *Journal of Food Engineering* 19(3); 1993; 291-301

The kinetic parameters (thermal death constant (calculated at 121.1°C) and z values) for heat inactivation of a quality factor in conduction-heated canned food were evaluated using the Complex optimization procedure and a numerical technique for heat-transfer calculations and quality-retention prediction. The jackknife method was used to evaluate experimental variability. This methodology was used to determine the thermal death constant (calculated at 121.1°C) and z values for thiamin destruction in pea puree (pH = 6.8, moisture content = 80.8%, and thermal diffusivity, $\alpha = 1.8 \times 10^{-7}$ m^2/s). Retort-processing experiments involving 303 x 406 cans filled with thiamin-enriched pea puree yielded a wide range of thamin-retention values (29-70%). Thermal death consant (calculated at 121.1°C) and z values were 304 plus/minus 32 min and 30 plus/minus 3°C, respectively. AA

1636

Alonso (AA), Perez (MRI), Shukla (NV) and Deshpande (PB). **On-line quality control of non-linear batch systems: application to the thermal processing of canned foods.** *Journal of Food Engineering* 19(3); 1993; 275-289

The recently developed Q-PI approach for quality control of linear continuous systems was extended to non-linear batch systems such as the thermal processing of canned foods. The new control law contains proportional and integral terms with which the operators are familiar. Quality control may be improved, or costs reduced, consistent with process specifications, by adjusting tuning constants of the controller. Performance of the control law is demonstrated on a simulated batch retort; results indicate the capability of the proposed approach for quality control of non-linear batch processes. AA

1637

Dohnal (M), Vystrcil (J), Dohnalova (J), Marecek (K), Kvapilik (M), Bures (P). **Fuzzy food engineering.** *Journal of Food Engineering* 19(2); 1993; 171-201

Classical quantitative (analytical and/or statistical) analyses are not appropriate for some ill-defined and/or very complex food engineering problems. Therefore, a new form of analysis using fuzzy mathematics was investigated. The fuzzy model utilizes data which, to a certain level, are inconsistent. To minimize losses of valuable knowledge, conventional pre-processing (usually statistical analysis) of knowledge is eliminated. Primary knowledge (e.g. experimental results) is used directly. Conventional experimental and other records used in food engineering are not suitable for efficient uncertainty reasoning. Revitalization of these records represents retrospective application of knowledge engineering algorithms. The final goal of revitalization is to insert additional information (e.g. expert guess) to increase reasoning power. 1 revitalization technique (fractal analysis) is presented. 2 realistic case studies (meat

chilling and malt modification) are reported in detail. BV

1638

Hendrickx (M), Silva (C), Oliveira (F) and Tobback (P). **Generalized (semi)-empirical formulae for optimal sterilization temperatures of conduction-heated foods with infinite surface heat transfer coefficients.** *Journal of Food Engineering* 19(2); 1993; 141-158

A computer program was developed to model heat sterilization of 1-dimensional conduction-heated foods with negligible surface resistance to heat transfer. The optimal sterilization temp., defined as the processing temp. that results in a food product with min. surface cook-value after achieving the desired degree of sterility, was calculated as a function of food properties (thermal diffusivity, Z-value of the quality factor), processing conditions (dimensions and geometry of the food or container, initial temp. of the product, heating medium come-up-time) and processing criteria (target F_0-value). The initial temp. of the food and the heating medium come-up-time have a minor effect on the optimal temp. Generalized (semi)-empirical formulae relating optimal sterilization temp. and all relevant variables were developed. AA

1639

Liu (H) and Lamb (J). **Modelling of the diffusion process in food over short times.** *Journal of Food Engineering* 19(4); 1993; 311-318

A simple mathematical model was developed to describe the diffusion process [in foods] in an infinite cylinder, a sphere and finite cylinders. The error involved in using the proposed model over the dimensionless time 0-0.25 is negligible. It offers a simpler method of calculating the diffusion process than using full-series solutions. AA

1640

de Elvira (C). **The use of alternating direction implicit methods to model diffusion phenomena in elliptic products.** *Journal of Food Engineering* 19(2); 1993; 159-170

Three alternating direction implicit (ADI) methods plus the Crank-Nicolson implicit method and an 8-noded isoparametric finite element method (both included for comparison purposes) were considered to solve numerically transient thermal or mass diffusion problems in elliptic shaped bodies. 3 domain discretization methodologies were proposed: polar cylindrical; and unequally and equally spaced orthogonal curvilinear coordinates. To indirectly analyse the effectiveness of the methods in different discretizing techniques, they were applied to water diffusion during rice grain soaking; the computed solutions were compared with experimental ones. Influences of various time and space discretizations upon results were studied. Numerical stability constraints of some of the methods used and performance orientations on personal computer applications are given. AA

1641

Lee (JH) and Singh (RK). **Residence time distribution characteristics of particle flow in a vertical scraped surface heat exchanger.** *Journal of Food Engineering* 18(4); 1993; 413-424

Residence times of 1.0, 1.5 and 2.0 cm potato cubes with 0.4, 0.8 and 1.2% aqueous solutions of sodium carboxymethylcellulose and flow rates of 453, 534 and 599 ml/s in a vertical scraped surface heat exchanger (SSHE) rotating at 60, 110 and 160 rpm were measured, and distribution characteristics of particle flow for each set of conditions were investigated. Pearson's x^2 goodness of fit test indicated that most of the individual particle residence time distributions in a vertical SSHE flow could be described by the gamma model, whereas many of the individual distributions fitted to the normal model in addition to the gamma model for horizontal SSHE. Orientation of SSHE appeared to be the important factor influencing the forces acting on the particles during flow in an SSHE. Particle-particle interactions, as well as a combination of process parameters, caused 'tailing' of some particles, resulting in skewed distributions to the right. AA

1642

Rynlecki (A) and Jayas (DS). **Automatic determination of model parameters for**

computer control of canned food sterilization. *Journal of Food Engineering* 19(1); 1993; 75-94

A method was developed for automatic detn. (and updating using an optimization technique) of the step-response model parameters for computer control of the sterilization of canned heterogenous mixed foods. The step-analysis method was used in developing the mth order exponential lag model (including a dead-time delay) to predict product temp. changes in the slowest heating point of a can. An algorithm for computerized calculation of the heating model parameters is shown. The optimum gradient method was modified and used to fit the model more accurately to the temp. data measured during first few min of heating. Values of the cooling model parameters were calculated, based on fixed ratios of these parameters to values of the heating model parameters. The model was employed for prediction of the cumulative lethality contributed by the cooling portion of a sterilization process ($F^c o$). This lethality was used in heating turn-off decisions. The model is fast and accurate for the purpose. The max. running-time required to predict $F^c o$ in each time interval during sterilization of 9% bentonite suspension in a 400 x 470 (101.6 x 119.4 mm) size can was only 2.6 s (when an IBM-PC/AT-286/12 MHz microcomputer is used). The method was validated in the laboratory using 5-9% bentonite suspensions. The final monitored cumulative lethality was within 18% of the desired cumulative lethality for these suspensions. AA

1643

Mwangi (JM), Rizvi (SSH) and Datta (AK). **Heat transfer to particles in shear flow: application in aseptic processing.** *Journal of Food Engineering* 19(1); 1993; 55-74

Convective heat transfer coeff. at the fluid-particle interface were obtained for shear flow in a holding tube to simulate aseptic processing of particle-containing liquid foods. The particles were made of polymethyl methacrylate and were suspended in a solution of glycerin in water. Particle temp. were monitored by placing at the particle centre a m.p. indicator that changed colour at a specific temp. The fluid-particle heat transfer coeff. varied between 58.3 and 1301.3 W/m^2 K for Reynold numbers of 73.1 and 369.4, and increased with increasing flow rate and particle to tube diam. ratio. Heat transfer was enhanced between 80 and 200% when the solids concn. was increased to 3.22% from a single particle suspension. The density difference between the particle and fluid was found to influence significantly the residence time of the particles within the holding tube. AA

1644

Zaror (CA), Pyle (DL) and Molnar (G). **Mathematical modelling of an ohmic heating steriliser.** *Journal of Food Engineering* 19(1); 1993; 33-53

Sterilization processes based on electrical heating may overcome some of the problems associated with conventional thermal sterilization methods. However, there is a lack of appropriate mathematical models of the process for design and process control. Sterilization based on ohmic heating was studied from first principles, and the governing equations were used to predict performance under a range of conditions. A number of limiting cases were examined and simpler models were formulated. The advantages of the process over conventional sterilization were demonstrated; the performance of the system under unfavourable conditions as studied. AA

1645

Smirnov (MS), Lysenko (VI) and Yegorova (SV). **Research on cyclic grain drying.** *Journal of Food Engineering* 18(2); 1993; 201-210

Presents the results of a study of wheat grain drying in an experimental plant simulating a storage bin where bulk wheat grain was subjected to intermittent ventilation. Grain drying curves and temp. curves for 4 layers were obtained at depth intervals of 0.4 m. Approximate equations for the grain drying curves and a mathematical model of moisture content in the bulk grain were determined as well as heat and mass transfer equations. Results indicated that alternating periods of ventilation and rest reduced drying time to ~1/3 of that of the continuous-flow method. Energy consumption was reduced by a factor of > 5. BV

1646

Fryer (PJ), de Alwis (AAP), Koury (E), Stapley (AGF) and Zhang (L). **Ohmic processing of solid-liquid mixtures: heat generation and convection effects.** *Journal of Food Engineering* 18(2); 1993; 101-125

1647

Lovatt (SJ), Pham (QT), Loeffen (MPF) and Cleland (AC). **A new method of predicting the time-variability of product heat load during food cooling. II. Experimental testing.** *Journal of Food Engineering* 18(1); 1993; 37-62

An ordinary differential equation (ODE) method of predicting the heat load-time profile of cooling and freezing foods was developed and tested against finite difference (FD) predictions for a selection of shapes. To test both the FD calculation and the ODE method against reality, a technique was developed to measure freezing food product heat load in an experimental freezer using the difference in temp. between air flowing onto and off the product. Heat balances for experimental runs were generally within 10% of their expected values. When the FD and ODE heat load predictions for a meat carton shape were compared with measured data, predictions matched real values to within the experimental uncertainty. ODE heat release predictions for lamb and sheep carcasses were also within about 10% of experimental data during most of the process, although it was necessary to modify the value of the 1 new parameter in the ODE method to deal with such highly irregular shapes. AA

1648

Lovatt (SJ), Pham (QT), Cleland (AC) and Loeffen (MPF). **A new method of predicting the time-variability of product heat load during food cooling. I. Theoretical considerations.** *Journal of Food Engineering* 18(1); 1993; 13-36

A new method was developed to predict the way in which the heat load placed upon a refrigeration system by cooling food products varies with time. This information is important to refrigeration system designers and plant operators as capital and running costs may depend strongly upon the heat load sustained by the system. The new method utilizes ordinary differential equation models of both chilling and phase change processes and requires only 1 parameter in addition to those required by existing freezing and chilling time prediction methods. The new method was tested against finite difference (FD) calculations under a wide range of conditions for those product shapes to which FD methods may be applied. It predicted the product heat load to within 10% of the FD estimate for all test cases, except at the very start and at the end of the cooling process. The method requires much fewer computational resources than FD, and is capable of extension to shapes not easily handled by FD methods. AA

1649

Datta (AK). **Error estimates for approximate kinetic parameters used in food literature.** *Journal of Food Engineering* 18(2); 1993; 181-199

For convenience, the z-value has been traditionally used to describe temp. dependence of reaction rates in food materials. This approximate parameter, z, linearizes a more common non-linear relationship described by the Arrhenius equation for temp. dependence. Whereas researchers have been concerned about the range over which such approximate linear relationships may be valid, this study provides quantitative data to that effect for the first time. The nature and extent of error in using the z-value, as compared to the use of Arrhenius parameters, was mathematically analysed. It is shown that for every time-temp. history, there exists a unique reference temp. that minimizes this error. If 121°C is always used as the reference temp. instead, severe calculation errors are possible for higher temp. processes such as UHT processing and lower temp. processes such as inactivation of enzymes. A formula is proposed to preserve the full Arrhenius accuracy while still using the available z-values for reactions. AA

1650

Vagenas (GK) and Karathanos (VT). **Prediction of the effective moisture diffusivity in gelatinized food systems.** *Journal of Food Engineering* 18(2); 1993; 159-179

Gelatinized food systems develop a porous structure during dehydration; therefore, the moisture diffusivity calculated from experiments should be considered as an effective diffusion coeff. The effective moisture diffusivity of gelatinized starches was determined from drying experiments using the method of slopes. A methodology is presented which permits the calculation of the effective moisture diffusivity from the diffusion coeff. of the 2 phases (air-solid) and the porosity of the system. The diffusion coeff. of the homogeneous solid phase (gel) was estimated from the calculated values of the effective diffusion coeff., using non-linear regression analysis. Its value was dependent on the moisture content and temp. and varied in the range 1.4×10^{-11} to 2.6×10^{-10} m^2/s for Amioca [high amylopectin powder] and 4.1×10^{-11} to 3.2×10^{-10} m^2/s for Hylon 7. AA

1651

Hicsasmaz (Z) and Clayton (JT). **Applicability and comparison of various techniques for measurement of wettability and contact angles between oil-based liquid and starch-based solid food materials.** *Journal of Food Engineering* 18(2); 1993; 127-143

Contact angles of various oils and chocolate syrup were estimated on a commercial brand of white sandwich bread and a commercial brand of butter cookies using 3 different methods: sessile drop geometry; sedimentation vol.; and immersion techniques. It was concluded that estimation of contact angles from sessile drop geometry by photographic techniques is not possible for oils due to absorption into the starch-based solids. In such cases, sedimentation vol. and immersion techniques were practical methods for rough estimates of contact angles when needed. For the non-Newtonian chocolate syrup, estimation of contact angles with the starch-based solids by sedimentation vol. was not possible due to the yield stress of chocolate syrup. However, in this case, contact angles could be estimated for sessile drop geometry. AA

1652

Maltini (E). **Estimation of the viscosities of the frozen sucrose-water system from glass transition temperatures.** *Italian Journal of Food Science* 5(4); 1993; 371-377

Viscosities of the amorphous phase of sucrose-water solutions at sub-freezing temp. were estimated according to the glass transition theory. This was done by correlating concn., glass transition temp. and freezing temp. with the Williams-Landel-Ferry model, starting from literature data. The method and results are discussed with reference to the kinetic interpretation of stability in frozen systems. AA

Equipments

1653

Qin (Z) and Litchfield (JB). **Fuzzy logic control for a continuous crossflow grain dryer.** *Journal of Food Process Engineering* 16(1); 1993; 59-77

Assembly and performance of a fuzzy logic control system in regulating a laboratory continuous crossflow grain drier are described. With fuzzy control, similar outlet moisture contents and lower outlet breakage susceptibility of corn were obtained as compared to the manually controlled drier operation. Results verified that drying-induced corn breakage could be reduced through the application of fuzzy logic control. Like the corn drying process, many food processes are difficult to control automatically with conventional control techniques due to their complex nature. Fuzzy logic control provides an attractive solution for control of those processes. AA

1654

Das (H) and Srivastav (PP). **Process modelling on a novel grain roaster.** *Journal of Food Engineering* 19(4); 1993; 341-351

A manually operated device for roasting and puffing grains using hot sand was developed. A built-in sieve removed roasted grains and retained hot sand within the device. Moisture diffusivity in bengalgram during roasting was estimated to be 10×10^{-9} m^2 s^{-1}; the overall heat-transfer coeff. for heating sand with a liquefied petroleum gas was 12 W m^{-2} K^{-1}. Temp. of sand and the grain and sand mixture

were determined using a lumped-heat-capacity model. Grain and sand temp. at the end of roasting, as predicted by the model, was between 207 and 222°C; measured values were from 201 to 205°C. The device roasted 4.2-4.9 kg h^{-1} of bengalgram; the value predicted by the model was 4.4-5.3 kg h^{-1}. BV

ENERGY IN FOOD PROCESSING

1655

Krishnappa (KG). **Study on electrical energy utilisation in roller flour milling industry.** *Indian Miller* 24(6); 1994; 16-20

Energy utilisation in roller flour milling - current status, energy accounting in wheat mills, factors contributing to higher specific energy (step down transformer, drives for roller flour mill machines), effects of partially loaded motors are discussed. SRA

FOOD CHEMISTRY AND ANALYSIS

Chemistry(Analytical)

1656

Martin (GJ), Hanneguelle (S) and Remaud (G). **Application of site-specific natural isotope fractionation studied by nuclear magnetic resonance (SNIF-NMR) to the detection of flavour and fragrance adulteration.** *Italian Journal of Food Science* 5(3); 1993; 191-213

Use of site-specific natural isotope fractionation studied by NMR (SNIF-NMR) for evaluating authentication of flavours and detecting adulteration is reviewed. Principles of the method are also described, together with its experimental requirements. Aspects covered include: isotopic fractionation - symbolism and definition; experimental methodology (sample treatment, NMR detn. of site specific isotope ratios); authentication of phenyl propanoid aromas; authentication of monoterpenic flavours and perfumes; and authentication of esters and lactones. BV

1657

Sievert (D) and Holm (J). **Determination of amylose by differential scanning calorimetry.** *Starch/Staerke* 45(4); 1993; 136-139

A DSC method for the detn. of amylose as its amylose-L-α-lysophosphatidylcholine (LPC) complex is described. Potato amylose/amylopectin mixtures covering the range 0-95% amylose were heated in the presence of LPC, cooled and then reheated to follow melting of the amylose-LPC complexes formed during the cooling phase. A linear relationship (r = 0.98) was obtained between the amylose content of the mixtures and enthalpies of amylose-lipid complexes. This linear calibration was used to predict the amylose content of various native starches, rice flours, wheat flour, durum wheat semolina and lyophilized raw potato on the basis of the melting enthalpy of their amylose-LPC complexes. Except for potato samples, amylose contents determined by the DSC method were in good agreement with those obtained from a colorimetric assay. AA

1658

Yukawa (N), Takamura (H) and Matoba (T). **Determination of total carbonyl compounds in aqueous media.** *Journal of the American Oil Chemists' Society* 70(9); 1993; 881-884

Reports a method to quantify aldehydes carbonyl compounds in aqueous media. Analysis is based on the reaction of 2,4-dinitrophenylhydrazine (2,4-DNP) with aldehydes and the subsequent formation of the quinoidal ion under basic conditions. Aldehyde containing samples react with acidic 2,4-DNP reagent at 50°C for 30 min. The mixture is then cooled in an ice bath prior to addition of a 10% KOH/80% alcohol solution. Following centrifugation, the absorbance of the mixture is determined at 425 nm, from which the total carbonyl compounds content can be calculated. The method was applied to the detn. of total aldehydes in aqueous food media (milk, soymilk and soybean homogenates). BV

FOOD MICROBIOLOGY AND HYGIENE

1659

Krings (U), Kelch (M) and Berger (RG). **Adsorbents for the recovery of aroma**

compounds in fermentation processes. *Journal of Chemical Technology and Biotechnology* 58(3); 1993; 293-299

Using a model solution of 12 aroma compounds, (including aldehydes, alcohols, esters, ketones and pyrazines), representative of microbial volatiles, 31 different adsorptive materials were investigated with regard to their solid phase extraction and desorption properties. Well known styrene-divinylbenzene-based resins and alternative adsorbents including zeolites, β-cyclodextrin and modified activated carbon were compared. Adsorption and desorption rates in aqueous solution were determined for each adsorbent. Isotherms and adsorption kinetics were determined for the most effective adsorbents. Activated carbon had the highest adsorptive rates but a poor desorption capability when used with organic solvents. The next best materials were styrene-divinylbenzene resins and zeolite. They possessed adsorption rates similar to activated carbon but also good desorption rates. The relative properties of adsorbents for downstream processing of microbial fermentations are discussed. AA

1660

Nidetzky (B) and Steiner (W). **A new approach for modeling cellulase-cellulose adsorption and the kinetics of the enzymatic hydrolysis of microcrystalline cellulose.** *Biotechnology and Bioengineering* 42 (4); 1993; 469-479

Two fractions of substrate in microcrystalline cellulose which differ in their adsorption capacities for cellulases and their susceptibility to enzymic attack were identified. On the basis of a two-substrate hypothesis, mathematical models to describe enzyme adsorption and hydrolysis kinetics were derived. A new nonequilibrium approach was chosen to predict cellulase-cellulose adsorption. A max. binding capacity of 76 mg protein/g substrate and a half-max. saturation constant of 26 filter paper units (FPU)/g substrate were calculated, and a linear relationship of hydrolysis rate vs. adsorbed protein was found. The fraction of substrate more easily hydrolysed, as calculated from hydrolysis data, represented 19% of the total effective substrate concn. This fraction was only slightly different from that of other celluloses and was estimated to be 27 and 30% for NaOH- and H_3PO_4- swollen cellulose, respectively. The effective substrate concn. is equal to the max. amount of substrate which can be converted during exhaustive hydrolysis. This in turn is determined by overall degradability of the substrate by the cellulases (85-90% for microcrystalline cellulose) and by the cellobiose concn. during hydrolysis. The kinetic model is based on a summation of 2 integrated 1st-order reactions with respect to the effective substrate concn. It includes the principal factors influencing the reaction rates: the ratio of filter paper and β-glucosidase units/g substrate and the initial substrate concn. AA

Enzymes

1661

Jungbae (K) and Dordick (JS). **Pressure affects enzyme function in organic media.** *Biotechnology and Bioengineering* 42 (6); 1993; 772-776

Pressure effects on enzyme function in nonaqueous media were investigated. Activation vol. were determined and provide evidence that the primary effect of pressure is to enhance the stripping of water from an enzyme in polar organic solvents, leading to decreased enzymic activity. Activation vol. of subtilisin Carlsberg in organic solvents, particularly with hydrated enzyme, were of a larger magnitude than activation vol. determined in aqueous solutions. Results provide further evidence that enzymic activity in polar organic solvents is dominated by the interaction of enzyme-bound water with the solvent. From a practical standpoint, however, results suggest that enzymic catalysis in organic solvents may be controlled by the combined effects of pressure and enzyme hydration. AA

Ethyl alcohol

1662

Ohta (K), Hamada (S) and Nakamura (T). **Production of high concentrations of ethanol from inulin by simultaneous saccharification and fermentation using *Aspergillus niger* and *Saccharomyces***

cerevisiae. *Applied and Environmental Microbiology* 59(3); 1993; 729-733

Pure nonhydrolysed inulin was converted directly to ethanol in a simultaneous saccharification and fermentation process. An inulinase-hyperproducing mutant, *Aspergillus niger* 817, was grown in submerged culture at 30°C for 5 days. The inulin-digestive liquid culture (150 ml) was supplemented with 45 g of inulin, 0.45 g of $(NH_4)_2SO_4$, and 0.15 g of KH_2PO_4. The medium (pH 5.0) was inoculated with ethanol-tolerant *Saccharomyces cerevisiae* 1200 and fermented at 30°C. An additional 20 g of inulin was added after 15 h fermentation. S. *cerevisiae* 1200 utilized 99% of the 65 g of inulin during fermentation, and produced 20.4 and 21.0% (v/v) ethanol from chicory and dahlia inulins, respectively, after 3 days of fermentation. Max. volumetric productivities of ethanol were 6.2 and 6.0 g/l/h for chicory and dahlia inulins, respectively. The conversion efficiency of inulin to ethanol was 83-84% of the theoretical yield. AA

Fermented foods

1663

Ferng (S) and Chiou (RYY). **Characterization of white particulates in brine of indigenous fermented foods.** *Journal of Food Protection* 56(3); 1993; 243-245

White particulates are occasionally observed in brine of indigenous fermented foods, including sufu, salt-preserved shellfish, oyster, finfish and pork. Products with and without visible particulates were collected and brines were analysed. The pH, salinity and alcohol content in brines with particulates were slightly higher than those without particulates. Differences of amino acid profiles were not significant. When particulates were isolated and subjected to amino acid analysis, only tyrosine and phenylalanine were present and accounted for 34.82 plus/minus 24.30% and 3.13 plus/minus 2.93% on a dry wt. basis, respectively. The particulates studied by SEM consisted largely of hollow particles. When particulates were dissolved in 0.4N HCl, evaporated for crystallization, and examined using stereo microscopy and an X-ray diffractometer, L-tyrosine crystals were observed. AA

Microorganisms

Bacteria

1664

Donnison (AM), Ross (CM) and Russell (JM). **Quality control of bacterial enumeration.** *Applied and Environmental Microbiology* 59(3); 1993; 922-923

The use of standard bacterial suspensions to test method performance, via control charts and also to test inhibition of recovery of bacteria when analysing water samples is considered. Variability in standard suspensions prepared from different strains and spp. and the use of frozen samples for quality control of spore and bacteriophage analyses of water quality are discussed. BV

Bacillus

1665

Georganta (G), Kaneko (T), Nakamura (N), Kudo (T) and Horikoshi (K). **Isolation and partial properties of cyclomaltodextrin glucanotransferase-producing alkaliphilic *Bacillus* spp. from a deep-sea mud sample.** *Starch/Staerke* 45(3); 1993; 95-99

Cyclomaltodextrin glucanotransferase (CGTase EC 2.4.1.19) producing alkaliphilic bacteria were isolated from deep-sea bottom mud samples. Isolates no. 3-22 and no. 1-7 were identified from their taxonomic characteristics as an alkaliphilic *Bacillus* sp. and an alkaliphilic *B. subtilis* strain, respectively. Isolate no. 3-22 grew at 4°C whereas isolate no. 1-7 did not. The crude enzymes of both strains showed activity in both broad temp. and broad pH (5-9) ranges. Isolate no. 3-22 produced as its major starch hydrolysis product, β-cyclodextrin (β-CD), and as minor products, α- and γ-CD. Isolate no. 1-7 produced as its major starch hydrolysis product, β-CD, and as its minor product, γ-CD; no α-CD was detected. AA

1666

Yongxiang (W) and Saha (BC). **Purification and characterization of thermophilic and**

alkalophilic tributyrin esterase from *Bacillus* strain A30-1 (ATCC 53841). *Journal of the American Oil Chemists' Society* 70(11); 1993; 1135-1138

An extracellular esterase (EC 3.1.1.1.) from thermophilic *Bacillus* A30-1 (ATCC 53841) was purified 139-fold to homogeneity by 6M NaCl treatment, ammonium sulphate fractionation (30-80%) and phenyl-Sepharose CL-6B column chromatography. Native enzyme was a single polypeptide chain with mol. wt. of approx. 65 000 and an isoelectric point at pH 4.8. Optimum pH for esterase activity was 9.0 (stability range, pH 5-10.5). Optimum temp. for enzyme activity was 60°C. Half-life of esterase was 28 h at 50°C, 20 h at 60°C and 16 h at 65°C. Highest activity was observed on tributyrin, with little or no activity on long-chain (12-20 carbon) fatty acid esters. K_m and k_{cat} were 0.357mM and 8365/min, respectively, for tributyrin hydrolysis at pH 9 and 60°C. Cyclodextrin (α-, β and γ), Ca^{2+}, Co^{2+}, Mg^{2+} and Mn^{2+} enhanced esterase activity and Zn^{2+} and Fe^{2+} inhibited activity. EDTA, p-chloromercuribenzoate and N-bromosuccinimide had no effects on activity. BV

Bacillus amyloliquefaciens

1667
Castro (GR), Balgori (MD), Mendez (BS) and Sineriz (F). **Effects of pH and temperature on the continuous production of amylolytic enzymes by *Bacillus amyloliquefaciens* MIR-41.** *Journal of Chemical Technology and Biotechnology* 58(3); 1993; 277-280

Bacillus amyloliquefaciens MIR-41 produces 3 exocellular amylolytic enzymes: α-amylase, pullulanase and α-glucosidase. Physicochemical factors such as pH and temp. may affect enzyme yield. Continuous culture at a dilution rate of 0.15 h^{-1} resulted in the max. production of α-amylase and α-glucosidase at 36°C and pH 6.8 and of pullulanase at 44°C and pH 5.6. Results suggest that combinations of temp. and pH might be used for production of crude extracts of α-amylase or pullulanase. AA

Bacillus cereus

1668
Benedict (RC), Partridge (T), Wells (D) and Buchanan (RL). **Bacillus cereus: aerobic growth kinetics.** *Journal of Food Protection* 56(3); 1993; 211-214

Three strains of *B. cereus* [F4810, an emetic toxin producing strain isolated from cooked rice; B4AC, a diarrhoeal toxin producing strain isolated from pea soup; and T, a reference strain] were cultured in brain heart infusion medium aerobically under conditions of variable temp. (5 to 42°C), NaCl concn. (0.5-5%), pH (4.5-7.5) and sodium nitrite concn. (0-200 mg/l) to simulate conditions of normal and adverse food storage. Cultures were sampled at selected times, and plate counts were used to calculate growth curves for each condition. None of the strains grew at 5°C, but growth did occur slowly at 8°C, and was most rapid at 37°C. Growth occurred in media without additives at all pH examined between 8 and 42°C. Decreasing the pH and increasing NaCl and sodium nitrite levels increased the lag phase and generation times of the organism. AA

Bacillus licheniformis

1669
Shalini Sen and Satyanarayana (T). **Optimization of alkaline protease production by thermophilic *Bacillus licheniformis* S-40.** *Indian Journal of Microbiology* 33(1); 1993; 43-47

One hundred and twenty thermophilic bacterial strains isolated from soil, compost and ground water samples on glucose-yeast extract-asparagine medium at 50°C were screened for alkaline protease activity. Strain S-40, the most potent producer of alkaline protease was identified as *Bacillus licheniformis*. Among 11 media combinations, enzyme production was high in soybean meal-starch medium. Alkaline protease accumulation was better in fructose and starch than the other carbon sources. There was no enzyme secretion in inorganic nitrogen or asparagine. The age of the inoculum had no adverse effect on enzyme secretion. Alkaline protease production was optimum at pH 8.0,

45°C and 200 r.p.m. with 2% level of inoculum. AA

Lactobacillus bulgaricus

1670
Venkatesh (KV), Okos (MR) and Wankat (PC). **Kinetic model of growth and lactic acid production from lactose by *Lactobacillus bulgaricus*.** *Process Biochemistry* 28(4); 1993; 231-241

Batch and continuous fermentation kinetics of *Lactobacillus bulgaricus* were examined. The batch kinetic model included the effect of pH, product (lactic acid) and substrate (lactose). The effect of pH on the enzyme β-galactosidase was reflected in the value of mumax, Monod's growth constant. Empirical expressions to estimate model parameters based on pH were established. These were used to estimate cell mass and lactic acid concn. for fermentations without pH control. At high pH, lactic acid was mostly formed by growth associated mechanisms and at low pH it was due to cell maintenance. The relationship between ATP concn. and cell mass in a batch fermentation could be approximated by a Leudeking-Piret like relationship. Continuous fermentations were studied by varying pH and initial substrate conditions. Max. productivity of 6.2 g/l per h was obtained at pH 5.6 for the CSTR (continuous stirred tank reactor) system, which was 3x the productivity obtained for a batch system at the same pH. The CSTR system had a high productivity over a very small range of retention times. 3 stages were sufficient to completely utilize the lactose, but at the cost of decreasing productivity to 4.8 g/l per h. AA

Listeria monocytogenes

1671
Yeu (H-D) and Schaffner (DW). **Modeling the effect of temperature on the growth rate and lag time of *Listeria innocua* and *Listeria monocytogenes*.** *Journal of Food Protection* 56(3); 1993; 205-210

Several mathematical models which predict growth rate and lag time as a function of temp. were compared. Growth rate and lag time of *Listeria innocua* PFEI and *L. monocytogenes* Scott A PFEI were determined in brain heart infusion broth between 275 and 319 K. TableCurve 3.01 was used to fit model parameters to *L. monocytogenes* data and to evaluate growth rate and lag time models. Growth rate models were validated using *L. monocytogenes* data from real dairy food systems. *L. innocua* grew faster than *L. monocytogenes* at temp. < 315 K and slower at temp. > 315 K. At temp. < 281 K, lag time of *L. monocytogenes* was longer than that of *L. innocua*. The r^2 and F values show that 4-parameter growth rate models fit data better than 6-parameter models. The 4-parameter Zwietering Square Root Model gives the best fit of all models used to predict growth rate. The 2-parameter models predict lag time better than models containing more parameters. The 2-parameter Square Root Model gives the best fit of all the models evaluated when a traditional method of determining lag time is used. The 2-parameter New Model gives the best fit of all models, when the Solberg method of determining lag time is used. 4 growth rate models are not only suitable for modelling growth rate of *L. monocytogenes* in brain heart infusion broth but are also suitable for modelling its growth rate in selected real dairy food systems. AA

Thermomonospora viridis

1672
Muramatsu (Y), Takahashi (K) and Nakamura (N). **Characterization of a maltogenic amylase of *Thermomonospora viridis* and application in branched cyclodextrin production.** *Starch/Staerke* 45(3); 1993; 99-104

Some kinetic characteristics and actions on various cyclodextrins (CD) of a maltogenic α-amylase of *Thermomonospora viridis* (TVA; EC 2.4.1.1) were examined in branched CD production. K_m values for hydrolysis of α-, β- and γ-CD by the enzyme were 6.5, 7.6 and 10.8mM, and apparent molecular activities (Kθ) for these saccharides were 11.0, 67.2 and 432.8 s^{-1}, respectively. Kθ values for various branched CD were remarkably smaller than those for unbranched CD. The TVA cleaved first the ring of maltosyl-β-CD; the branched nonasaccharide formed was immediately degraded to give branched hexa- and

penta-saccharides with simultaneous formation of smaller unbranched saccharides. The enzyme also released a glucose molecule from the side chain of maltosyl-β-CD to give glucosyl-β-CD which was readily degraded to smaller saccharides. α-Amylase from *T. viridis* had an ability to hydrolyse unbranched CD preferentially in the presence of significant amounts of branched CD. These characteristics of the enzyme are consistent with its potential industrial use in branched CD production. AA

Fungi

Aspergillus

1673

Pitt (JI). **Corrections to species names in physiological studies on *Aspergillus flavus* and *Aspergillus parasiticus*.** *Journal of Food Protection* 56 (3); 1993; 265-269

A review of papers reporting physiological studies on the aflatoxin producing fungi *Aspergillus flavus* and *Asp. parasiticus*. 49 references. CSA

Rhizopus arrhizus

1674

Federici (F), Moresi (M), Parente (E), Petruccioli (M) and Piccioni (P). **Effect of stirring rate and neutralising agent on fumaric acid production by Rhizopus arrhizus.** *Italian Journal of Food Science* 5(4); 1993; 387-396

The optimal operating conditions for fumaric acid production by Rhizopus arrhizus from commercial hydrolysates of corn starch (i.e. glucose molasses) in shake flasks were transferred to a laboratory-stirred fermenter and checked with respect to the impeller speed (n) and neutralizing reagent added to control the pH of the medium. Regardless of the impeller speed in the range 450-1000 rpm, fumaric acid excretion was regarded as a non-growth associated process, because the mycelial biomass concn. in the production medium remained almost constant. When using $CaCO_3$ to control the pH, it was possible to reproduce satisfactorily the fumaric acid yields observed in the shake flasks only by increasing n from 450 to 800 rpm. Then, a soluble alkaline reagent (8M KOH + 1M K_2CO_3) was used to control the pH so as to minimize the heavy foam formation problems due to calcium fumarate production. Even if this procedure resulted in a higher yield factor for acid formation, the experimental fumaric acid yield coeff. practicaly coincided with those observed at n = 800 rpm in the presence of $CaCO_3$, thus making it useless to increase the stirrer speed to 1000 r.p.m. AA

Yeasts

1675

Martin (AM), Acheampong (E) and Patel (TR). **Production of astaxanthin by *Phaffia rhodozyma* using peat hydrolysates as substrate.** *Journal of Chemical Technology and Biotechnology* 58(3); 1993; 223-230

Peat hydrolysates prepared with and without acid and under various temp. were tested for the growth of the yeast *P. rhodozyma* ATCC 24202, which synthesizes carotenoids, including astaxanthin. The hydrolysate that resulted in the best growth of *P. rhodozyma* biomass was subsequently used as substrate for submerged culture of the yeast, and growth conditions were optimized. Conditions studied included initial substrate concn., initial pH, incubation temp., fermentation time and agitation rate. Optimum growth conditions produced approx. 4.6 g dm^{-3} of dry biomass with a crude protein content of 47% (dry wt. basis). The mean astaxanthin content of the yeast cultivated under these conditions, 1567 $\mu g\ g^{-1}$ dry yeast, was also the highest produced in this study, and compared favourably with results from the literature. AA

1676

Arica (MY) and Hasirci (V). **Immobilization of glucose oxidase: a comparison of entrapment and covalent bonding.** *Journal of Chemical Technology and Biotechnology* 58(3); 1993; 287-292

Glucose oxidase [EC 1.1.3.4, from Aspergillus niger] was immobilized onto poly(2-hydroxyethyl methacrylate) (pHEMA) membranes by 2 methods: by covalent bonding

through epichlorohydrin and by entrapment between pHEMA membranes. Highest immobilization efficiencies were 17.4 and 93.7% for covalent bonding and entrapment, respectively. K_m values were 5.9, 8.8 and 12.4 mmol dm^{-3} for free, bound and entrapped enzyme, respectively. V_{max} values were 0.071, 0.067 and 0.056 mmol dm^{-3} min^{-1} for free, bound and entrapped enzyme, respectively. When the medium was saturated with O_2, K_m was not significantly altered but V_{max} was. Optimum pH values for free, covalently-bound and entrapped enzyme were 5, 6 and 7, respectively. Optimum temp. was 30°C for free or covalently-bound enzyme but 35°C for entrapped enzyme. The deactivation constant for bound enzyme was 1.7×10^{-4} min^{-1} and 6.9×10^{-4} min^{-1} for entrapped enzyme. AA

1677

Hay (JD). **Novel yeast products from fermentation processes.** *Journal of Chemical Technology and Biotechnology* 58(2); 1993; 203-205

Novel products of interest to the food industry obtained from yeast fermentations are considered. They include enzymes (invertase, lactase or beta-galactosidase, recombinant enzymes including chymosin); nutrients and functional food ingredients (proteins, minerals, group B vitamins, emulsifiers and stabilizers); flavourings (yeast extract, umami); and yeasts as food colourings (including *Phaffia*, *Rhodotorula*, *Cryptococcus* and *Sporobolomyces*, yeast cell colours range from yellow to red). BV

1678

El Sharkawy (SH), Dostal (L) and Rosazza (JPN). **Microbiological transformations of lipids: acyl-specific hydrolysis of lard by yeasts.** *Applied and Environmental Microbiology* 59 (3); 1993; 725-728

Fatty acid and positional specificities of *Saccharomyces cerevisiae* (UI-SACCH) and *Schizosaccharomyces octosporus* (NRRL Y-854) in the hydrolysis of lard were studied by using GLC. Synthetic triglycerides were used to determine positional specificities of lipases of both organisms. Palmitic acid was specifically cleaved from all 3 triglyceride ester positions by *Sacch. cerevisiae*, while *Schizosacch. octosporus* cleaved stearic acid at either position 1 or position 3 of the glycerol moiety. Preparative scale fermentation with 200 g of lard per l yielded 48.4 g of palmitic acid per l with *Sacch. cerevisiae* and 42 g of stearic acid per l with S. octosporus. The free fatty acids produced by microbiol bioconversion of lard were characterized spectrally (-1H- and CNMR and MS) and chromatographically (TLC and GC). AA

Candida cylindracea

1679

Tanaka (Y), Funada (T), Hirano (J) and Hashizume (R). **Triglyceride specificity of *Candida cylindracea* lipase: effect of docosahexaenoic acid on resistance of triglyceride to lipase.** *Journal of the American Oil Chemists' Society* 70(10); 1993; 1031-1034

Tuna oil was hydrolysed with *Candida cylindracea* lipase. After 70% hydrolysis of the oil, the docosahexaenoic acid (DHA) content in the glyceride mixture [a mixture of TG (triglyceride), DG (diglyceride) and MG (monoglyceride)] was twice that of the original oil. DHA-rich TG and DG were observed, but DHA-rich MG was absent. *C. cylindracea* lipase appeared to have a 'triglyceride specificity', and it favours TG without DHA over TG containing DHA. In accordance with this hypothesis, TG containing a mixture of oleic acid (OA) and DHA was synthesized and then hydrolysed with *C. cylindracea* lipase. TGs in the hydrolysis product were fractionated and analysed quantitatively by HPLC. 4 kinds of TG were obtained. TG with 3 molecules of OA was hydrolysed most easily. Increasing the DHA content of TG resulted in less hydrolysis of TG. The results suggested that *C. cylindracea* lipase had a TG specificity for the whole structure of TG in preference to the individual ester bonds; OA coexisting with DHA in TG was resistant to *C. cylindracea* lipase due to the TG structure. AA

Kluyveromyces marxianus

1680

Harsa (S), Zaror (CA) and Pyle (DL). **Production of polygalacturonases from *Kluyveromyces***

***marxianus* fermentation: preliminary process design and economics.** *Process Biochemistry* 28(3); 1993; 187-195

A simple 1-stage downstream processing scheme for recovery of polygalacturonase from *K. marxianus* fermentation is described. The optimum pH for ion exchange was 4.5, which, being compatible with fermentation conditions, meant that broth could be centrifuged and directly applied to an ion-exchange column; the process resulted in > 90% recovery of highly purified enzyme. Economic analysis of a repeated batch process showed that recovery of other by-products (cells and ethanol) was only of marginal importance, whilst enzyme production was highly profitable. There were strong economies of scale, up to a fermentation batch scale of around 20 m^3, with 100 batches per yr. Under typical conditions, analysis predicted a payback time < 1 yr. AA

BIOTECHNOLOGY

1681

Sashihara (N), Nakamura (N) and Horikoshi (K). **Subcloning and nucleotide sequencing of the pul gene of *Thermus* sp. AMD-33.** *Starch/Staerke* 45(4); 1993; 144-150

The nucleotide sequence of a thermostable pullulanase [pullulan 6-glucanohydrolase, EC 3.2.1.41] gene pul of *Thermus* sp. AMD-33 was determined. A single open reading frame of 2154 bp was found which encodes a protein of mol. wt. 80 327. Pullulanase purified from an *Escherichia coli* transformant harbouring the plasmid-encoded pul gene had a mol. wt. of 81 000 Da, as determined by SDS-PAGE. The plasmid-encoded enzyme was inhibited by pCMB, however, activity was recovered after treatment with 2-mercaptoethanol. The N-terminal region of the amino acid sequence was almost identical to that deduced from the DNA sequence. No signal peptide-like sequence could be detected. Amino acid sequence analysis revealed that 4 regions out of 6 which are characteristically found in amylases were conserved in the plasmid-borne pullulanase, but no amylase activity could be detected. AA

1682

Arica (MY), Sharif (FA), Alaeddinoglu (NG), Hasirci (N) and Hasirci (V). **Covalent immobilization of *Aspergillus niger* on pHEMA membrane: application to continuous flow reactors.** *Journal of Chemical Technology and Biotechnology* 58(3); 1993; 281-285

Poly(2-hydroxyethyl methacrylate) (pHEMA) membrane was prepared via photopolymerization and activated with epichlorohydrin. Conidia of *Aspergillus niger* (wild type NRRL-3 and genetically improved strain NRRL-3/2-2A) were covalently immobilized on the membranes. The uniform growth of *A. niger* cells on membrane surfaces was verified by SEM. Glucose oxidase (GOD) activity of immobilized cells was determined in a continuous flow membrane reactor (CFMR) by assaying for hydrogen peroxide produced. The activity was also determined in culture fluids of *A. niger* strains, freely grown in batch cultures. The CFMR was run with 0.1 mol dm^{-3} glucose with a fixed flow rate of 20 cm^3 h^{-1} for 60 h during which a 10% loss of original activity was detected. Loss of activity with freely cultivated mycelia was about 50% after 30 h. GOD activity of strain NRRL-3/2-2A was about 20x higher whether in immobilized or in free form. GOD activity of immobilized *A. niger* strains in the CFMR was 2.5x better than their counterparts freely grown in batch cultures indicating that immobilization increases the GOD activity and the stability of these microorganisms. AA

1683

Paavilainen (S), Hellman (J) and Korpela (T). **Purification, characterization, gene cloning, and sequencing of a new β-glucosidase from *Bacillus circulans* subsp. *alkalophilus*.** *Applied and Environmental Microbiology* 59(3); 1993; 927-932

An intracellular β-glucosidase was purified from cell extracts of *Bacillus circulans* subsp. alkalophilus by NAD affinity and high performance anion -exchange chromatographies. The enzyme was active against a wide range of aryl-β-glucosides and β-linked disaccharides. The structural gene for β-glucosidase was cloned in *Escherichia coli*. The β-glucosidase gene consisted of an open reading frame of 1350 bp encoding a protein of

450 amino acids with a calculated Mr of 51 303. The enzyme exhibited from 45 to 66% identity with 5 bacterial β-glucosidases. AA

1684

Van Rijssel (M), Smidt (MP), Van Kouwen (G) and Hansen (TA). **Involvement of an intracellular oligogalacturonate hydrolase in metabolism of pectin by *Clostridium thermosaccharolyticum*.** *Applied and Environmental Microbiology* 59(3); 1993; 837-842

The enzymes pectin methylesterase and polygalacturonate hydrolase, which are responsible for the initial steps of pectin degradation by *Cl. thermosaccharolyticum*, were induced on the polymeric substrates pectin and pectate, and on oligogalacturonates, but were repressed in the presence of glucose. Digalacturonate and trigalacturonate produced by the extracellular pectin methylesterase-polygalacturonate hydrolase complex were transported across the cytoplasmic membrane and hydrolysed by an inducible oligogalacturonate hydrolase to galacturonate. The oligogalacturonate hydrolase was separated from the polygalacturonate hydrolase and characterized. Its temp. optimum was 65°C, and its pH optimum was 6. The native molecular size was 90 kDa, and the enzyme was stable for greater than 1 h at 65°C. The max. reaction rate on oligomers decreased with increasing degree of polymerization. Galacturonate was released by hydrolysis from the nonreducing end of the oligomer. Amounts of pectic enzymes produced were all correlated to the amount of biomass formed. Galacturonate was metabolized via a modified Entner-Doudoroff route. AA

1685

Van Rijssel (M), Gerwig (GJ) and Hansen (TA). **Isolation and characterization of an extracellular glycosylated protein complex from *Clostridium thermosaccharolyticum* with pectin methylesterase and polygalacturonate hydrolase activity.** *Applied and Environmental Microbiology* 59(3); 1993; 828-836

An extracellular protein complex was isolated from the supernatant of a pectin-limited continuous culture of *Cl. thermosaccharolyticum* Haren. The complex possessed both pectin methylesterase (EC 3.1.1.11) and exo-poly-α-galacturonate hydrolase (EC 3.2.1.82) activity and produced digalacturonate from the nonreducing end of pectin chains. The protein consisted of 230- and 25-kDa subunits. The large subunit contained 10% (wt./wt.) sugars (N-acetylgalactosamine and galactose). Under physiological conditions both activities acted in a coordinated manner: the ratio between methanol and digalacturonate released during degradation was constant and equal to the degree of esterification of the pectin used. Prolonged incubation of the enzyme with pectin led to a nondialysable fraction that was enriched in neutral sugars, such as arabinose, rhamnose, and galactose; the high rhamnose/galacturonic acid ratio was indicative of hairy region-like structures. The smallest substrate utilized by the hydrolase was a tetragalacturonate. V_{max} with oligogalacturonates increased with increasing chain length. K_m and V_{max} values for the polygalacturonate hydrolase with citrus pectate as a substrate were 0.8 g l^{-1} and 180 μmol min^{-1} mg of $protein^{-1}$, respectively. K_m and V_{max} for the esterase with citrus pectin as a substrate were 1.2 g l^{-1} and 440 μmol min^{-1} mg of $protein^{-1}$, respectively. Temp. optima for the hydrolase and esterase were 70 and 60°C, respectively. Both enzyme activities were stable for greater than 1 h at 70°C. The exo-polygalacturonate hydrolase of *Cl. thermosulfurogenes* was partially purified while the methylesterase was also copurified. AA

1686

Heery (DM) and Dunican (LK). **Cloning of the trp gene cluster from a tryptophan-hyperproducing strain of *Corynebacterium glutamicum*: identification of a mutation in the trp leader sequence.** *Applied and Environmental Microbiology* 59(3); 1993; 791-799

Corynebacterium glutamicum ATCC 21850 produces up to 5 g of extracellular L-tryptophan per l in broth culture and displays resistance to several synthetic analogues of aromatic amino acids. Cloning of

the tryptophan biosynthesis (trp) gene cluster of this strain on a 14.5-kb BamHI fragment is reported. Subcloning and complementation of *Escherichia coli* trp auxotrophs revealed that as in *Brevibacterium lactofermentum*, the *C. glutamicum* trp genes are clustered in an operon in the order trpE, trpD, trpC, trpB, trpA. The cloned fragment also confers increased resistance to the analogues 5-methyltryptophan and 6-fluorotryptophan on *E. coli*. The sequence of the ATCC 21850 trpE gene revealed no significant changes when compared to the trpE sequence of a wild-type strain reported previously. However, analysis of the promoter-regulatory region revealed a nonsense (TGG-to-TGA) mutation in the third of 3 tandem Trp codons present within a trp leader gene. PCR amplification and sequencing of the corresponding region confirmed the absence of this mutation in the wild-type strain. RNA secondary-structure predictions and sequence similarities to the *E. coli* trp attenuator suggest that this mutation results in a constitutive antitermination response. AA

1687

Davis (R), van der Lelie (D), Mercenier (A), Daly (C) and Fitzgerald (GF). **ScrFI restriction-modification system of *Lactococcus lactis* subsp. *cremoris* UC503: cloning and characterization of two ScrFI methylase genes.** *Applied and Environmental Microbiology* 59(3); 1993; 777-785

Two methylase genes from total genomic DNA of the dairy starter culture *Lactococcus lactis* subsp. *cremoris* UC503, encoding ScrFI modification enzymes, were cloned and expressed in *Escherichia coli*. No homology between the 2 methylase genes was detected. Inverse PCR of flanking chromosomal DNA indicated that both were linked on the *Lactococcus genome*. Neither clone encoded the cognate endonuclease. The DNA sequence of 1 of the methylase genes (encoded by pCI931M) was determined and consisted of an open reading frame 1170 bp long, which could encode a protein of 389 amino acids (Mr, 44 500). The amino acid sequence contained the highly characteristic motifs of an m-5C methylase. Extensive regions of homology were observed with the methylases of NlaX, EcoRII, and Dcm. AA

1688

Jian (J-Z), Fujiyama (K), Seki (T) and Yoshida (T). **On-line monitoring of cell concentration of *Perilla frutescens* in a bioreactor.** *Biotechnology and Bioengineering* 42(4); 1993; 542-546

In situ real-time monitoring of *P. frutescens* biomass in a bioreactor was studied using a laser turbidimeter. Turbidity measurements at 780 nm with the laser sensor were hardly affected by the red colour of the anthocyanin produced by *P. frutescens* cells, nor by the aeration rate or agitation speed of the bioreactor. There was a linear relationship ($r^2 > 0.99$) between the sensor's response and cell concn. Each growth stage of the cells, i.e., lag, logarithmic, and stationary phases, could be estimated online by means of the *in situ* turbidimeter. However, during the declining phase of cells, an apparent deviation was observed between online estimations and off-line measurements of cell concn. by dry cell wt. This deviation was caused by a decrease in cell density due to an increase of individual cell volume and a decrease of cell dry wt. during the declining phase. AA

1689

Prazeres (DMF), Lemos (F), Garcia (FAP) and Cabral (JMS). **Modeling lipolysis in a reversed micellar system. II. Membrane reactor.** *Biotechnology and Bioengineering* 42(6); 1993; 765-771

Olive oil hydrolysis using *Chromobacterium viscosum* lipase B in a reversed micellar media was investigated in a membrane reactor. The dynamic evolution of product concn. both in the concentrate and permeate stream was analysed using a mechanistic model. A kinetic law with a 2nd-order dependence on substrate concn. and nonlinear product inhibition best described hydrolysis data over an extensive range of time and substrate concn. Results are discussed in terms of specific interactions occurring in the membrane reactor. AA

1690

Prazeres (DMF), Lemos (F), Garcia (FAP) and Cabral (JMS). **Modeling lipolysis in a reversed micellar system. I. Conventional batch**

reactor. *Biotechnology and Bioengineering* 42(6); 1993; 759-764

Triglyceride hydrolysis using Chromobacterium viscosum lipase B in a reversed micellar media was investigated in a batch-type reactor. The dynamic evolution of product concn. was analysed using several mechanistic models. A kinetic model with nonlinear product inhibition best described batch hydrolysis data over an extensive range of time and substrate concn. The rate equation obtained described the time course of reactions performed in this work, at different water contents (W_o = 7, 24) and pH values, and also experimental results obtained from the literature with a *Candida rugosa* lipase. AA

1691

Harcum (SW) and Bentley (WE). **Response dynamics of 26-, 34-, 39-, 54-, and 80-kDa proteases in induced cultures of recombinant *Escherichia coli*.** *Biotechnology and Bioengineering* 42(6); 1993; 675-685

Heterologous protein in recombinant *Escherichia coli* elicits a response similar to the heat-shock response, which includes enhanced proteinase expression. The present work detects, quantifies and characterizes intracellular proteinase activity in *E. coli* that were 'shocked' by the induction of a recombinant protein, CAT [chloramphenicol acetyltransferase], which is an endogenous protein in some *E. coli* strains. A SDS-gelatin-PAGE method was used to detect, quantify and characterize the presence of the proteinases. A hypothesis is proposed which links amplified proteinase activity to a temporary depletion of specific amino acid pools, and a stringent-like stress response. AA

1692

Ong (E), Gilkes (NR), Miller (RCJr), Warren (RAJ) and Kilburn (DG). **The cellulose-binding domain (CBDCex) of an exoglucanase from *Cellulomonas fimi*: production in *Escherichia coli* and characterization of the polypeptide.** *Biotechnology and Bioengineering* 42(4); 1993; 401-409

The gene fragment encoding the cellulose-binding domain (CBD) of an exoglucanase (Cex) from *Cellulomonas fimi* was subcloned and expressed in *E. coli*. Transcription from the lac promoter coupled with translation from a consensus prokaryotic ribosome binding site led to the production of large quantities of CBDCex (up to 25% total soluble cell protein). The polypeptide leaked into the culture supernatant (up to 50 mg l^{-1}), facilitating 1-step purification by affinity chromatography on cellulose. The 11-kDa polypeptide reacted with Cex antiserum. Absence of free thiols indicated that the 2 Cys residues of CBD_{Cex} form a disulphide bridge. It had the same N-terminal amino acid sequence as CBD_{Cex} prepared from Cex by proteolysis, plus 2 additional N-terminal amino acid residues (Ala and Ser) encoded by the N_{hel} site introduced during plasmid construction. CBD_{Cex} bound to a variety of β-1,4-glycans with different affinities and saturation levels. Adsorption to bacterial microcrystalline cellulose was dependent on temp., but not on pH. AA

TISSUE CULTURE

1693

Kurata (H) and Furusaki (S). **Immobilized *Coffea arabica* cell culture using a bubble-column reactor with controlled light intensity.** *Biotechnology and Bioengineering* 42(4); 1993; 494-502

FOOD ADDITIVES

Nil

CEREALS

Quinoa

1694

Ruales (J), Valencia (S) and Nair (B). **Effect of processing on the physico-chemical characteristics of quinoa flour (*Chenopodium quinoa*, Willd).** *Starch/Staerke* 45(1); 1993; 13-19

The nature and extent of the modification of starch in quinoa due to various processes such as cooking and autoclaving of the seeds, drum drying of the flour and extrusion of the grits were investigated by measuring physicochemical properties - water absorption, water solubility, swelling power, viscosity and degree of gelatinization - of processed samples. Autoclaved samples showed the lowest degree of gelatinization (32.5% by DSC) of starch, while the degree of gelatinization of the precooked/drum dried samples was 97.4% by DSC. Higher polymer degradation was observed in cooked samples than in autoclaved samples as determined by gel chromatography. The water solubility of cooked samples (5.44-15.58) and autoclaved samples (7.02-9.64) increased with process time. In the extrusion process, the moisture content as well as the compression ratio significantly ($P < 0.01$) affected degree of starch modification. BV

Rice

1695

Murugesan (G) and Bhattacharya (KR). **Interrelationship between some structural features of paddy and indices of technological quality of rice.** *Journal of Food Science and Technology (India)* 31(2); 1994; 104-109

Data on structural features of 25 var. of paddy revealed that grain breadth was positively correlated with white belly (chalkiness on ventral side) and negatively with the tightness of husk interlocking. The latter could be indexed inversely by the ease of shelling of paddy; but shellability was influenced positively by grain breadth also. Rice hardness was adversely affected by grain chalkiness, but hardness also differed among var. due to other reasons. Grain cracking was correlated positively with grain chalkiness and negatively with grain hardness and husk interlocking score. A max. brown rice breadth of 2.3 mm, a max. shellability of 75% and a min. popping expansion of 12 times could be useful as simple screening indices for acceptable technological quality of rice and for rapid screening of breeding lines. AA

1696

Madhuri Kelkar, Pratima Shastri and Rao (BY). **Microscopic structure and carbohydrate digestibility of ready-to-eat puffed rice products.** *Journal of Food Science and Technology (India)* 31(2); 1994; 110-113

In vitro carbohydrate digestibility of ready-to-eat puffed products from rice, such as *lahi* (puffed paddy), *poha* (beaten rice), *murmura* (puffed rice), and *chiwdi* (puffed poha), was determined using pancreatic and salivary amylases, separately. It was found that puffing enhanced the digestibility, as against the decrease in case of flaking. The data on the extent of starch gelatinization in these products indicated that gelatinization was a pre-requisite for puffing and also for increase in digestibility. However, gelatinization was not the only factor in enhancing digestibility of puffed products. Microscopic studies on the structure of these products gave interesting trends. AA

1697

Amarjeet Kaur and Sekhon (KS). **Evaluation of nutritional quality of parboiled rice.** *Journal of Food Science and Technology (India)* 31(2); 1994; 162-164

Feeding trials were conducted on albino rats for 28 days using reference casein diet, raw rice diet and the diets based on pressure parboiled rice as well as traditionally parboiled rice. Protein efficiency ratio (PER) did not vary significantly for different groups. However, PER value was the highest for rats fed on casein diet, followed by raw rice diet, pressure parboiled rice diet and traditionally parboiled rice diet respectively. AA

1698

Grenus (KM), Hsieh (F) and Huff (HE). **Extrusion and extrudate properties of rice flour.** *Journal of Food Engineering* 18(3); 1993; 229-245

Rice flour was extruded with a fully intermeshing, co-rotating twin-screw extruder (APV Baker MPF50/25). Rice bran was added at levels of 10, 20 and 30%. All treatments were run at screw speeds of 200 and 300 r.p.m. Both specific energy and product temp. in the metering section decreased on addition of rice

bran and increased at the higher screw speed. Both radial and axial expansion increased at 10% rice bran and decreased at higher levels. Shear strength increased with bran levels greater than 10% and with increase in screw speed. Extrudates that contained bran were darker than those that did not. An examination of the puff microstructure showed an increase in structural organization at 10% rice bran levels and decreased cell size and incomplete cells at higher levels. AA

1699

Seow (CC) and Thevamalar (K). **Internal plasticization of granular rice starch by hydroxypropylation: effects of phase transitions associated with gelatinization.** *Starch/Staerke* 45(3); 1993; 85-88

At a 1:1 starch/water ratio, a progressive shift of biphasic gelatinization endotherms to lower temp. as well as a broadening and shortening of the G endotherm with increasing molar substitution were observed, indicating increased internal plasticization and destabilization of the amorphous regions of the starch granules. Overall enthalpy of gelatinization was also reduced. Hydroxypropyl groups, which are attached to starch molecules primarily in the amorphous regions of starch granules, behave as flexible side chains. The motion of these side chains creates a large amount of free vol., thereby lowering the glass transition and crystallite melting temp. associated with starch gelatinization. Modified starch granules may thus be viewed as internally plasticized polymer resins which are more easily gelatinized than the unmodified starch. AA

1700

Nishimura (K), Kida (K), Nakagawa (M), Yahata (K) and Sonoda (Y). **Production of spirit from crushed rice by non-cooking fermentation using a bench-scale plant.** *Process Biochemistry* 28(3); 1993; 147-153

A non-cooking-fermentation (NCF) system was evaluated for rice spirits using both small-scale and bench pilot-scale equipment. The system utilized a commercially available fungal enzyme from Rhizopus as the saccharifying agent together with citric acid. Fermentation was optimized for both temp. and seed inoculum size. Fermentation products from bench-scale equipment were distilled under vacuum or atm. conditions and distillates were assessed by a taste panel. Distillates produced under atm. conditions from NCF compared favourably with those produced from cooking-fermentation. This method of production results in significant savings of labour and energy if operated on a production scale. BV

Wheat

1701

Balasubramanyam (N) and Murali Krishna (V). **Sorption characteristics and packaging of milled wheat products.** *Indian Miller* 24(6); 1994; 33-39

Studies on moisture, sorption at 27°C, RH 11-92%, packaging (HDPE, LDPE) and storage of wheat and wheat products (*atta* - whole wheat flour, maida, soji) indicated that moisture content of 12% for wheat, and 13% for *atta*, maida and soji were critical with respect to keeping quality; and that products packed in LDPE had 30-40 days storage life at 90% RH, 38°C, and 105 days at 65% RH, 27°C. SRA

1702

Greevani (P). **Wheat products consumer perspectives and requirements.** *Indian Miller* 23(5); 1993; 34-36

Compared to rice, coarse grains, other cereals and pulses the contribution of wheat to the total food grains is shown to increase consistently from 1950-51 to 1987-88. From the production and procurement of wheat from 1982-83 to 1984-85 it is estimated that wheat production will touch 74 t by 2000 AD. along with the above, growing urbanisation, nutrition and health awareness wheat products need to be modified to suit the taste and purchase power of consumers. Quality atta, maida, suji, var. of breads, biscuits, pastes, pizzas, breakfast and snack foods should be provided. SD

1703

Ryu (GH) and Walker (CE). **Emulsifer effects on pasting properties of wheat flour extrudates with/without sucrose and shortening.** *Starch/Staerke* 45(2); 1993; 65-70

Ground extrudate pasting properties were measured in the rapid viscoanalyser (RVA). 4 pasting parameters were determined from the RVA curve: peak time (PT), peak viscosity (P), breakdown viscosity (H) and initial slope (IS). Emulsifier types and the addition of sucrose and shortening significantly affected PT, P, H and IS. Emulsifiers significantly increased PT and H and decreased P and IS. Glyceryl monostearate had the greatest effects on these parameters. Sucrose and shortening generally enhanced the effects of emulsifiers on pasting properties. BV

1704

Lorenz (K), Kulp (K), Every (D) and Larsen (N). **Effect of heat damage on the baking quality of starch extracted from wheat.** *Starch/Staerke* 45(1); 1993; 25-30

Eight wheat samples of 4 cv., grown in different regions of New Zealand, were heated at 75-110°C. Starches were isolated from the treated and untreated flour samples. The baking potentials of the starches were estimated from remix baking tests using a starch gluten system. Heat-damage to wheats had a significant adverse effect on the baking performance of starches isolated from these wheats. This effect was not as large as the effect on gluten quality. Heat-damage caused no apparent alterations in starch physicochemical parameters as measured by SEM, amylograph pasting, gelatinization ranges, X-ray diffraction, swelling power and solubility, and water hydration capacity. BV

MILLETS

Barley

1705

Vainionpaeae (J), Forssell (P) and Virtanen (T). **High-pressure gelatinization of barley starch at low moisture levels and elevated temperature.** *Starch/Staerke* 45(1); 1993; 19-24

High-pressure gelatinization of barley starch at low water contents and at elevated temp. was performed in a differential scanning calorimeter equipped with a pressure chamber. Microscopic examination of the samples showed complete loss of birefringence and rupture of granular structure in most samples. Results indicated that enthalpy levels much higher than those in high-moisture gelatinization are needed to attain proper gelatinization and plastification of starch at low water contents. AA

1706

Sanchis (V), Sanclemente (A), Usall (J) and Vinas (I). **Incidence of mycotoxigenic *Alternaria alternata* and *Aspergillus flavus* in barley.** *Journal of Food Protection* 56(3); 1993; 246-248

The predominant fungal spp. present in 60 samples of barley collected in Spain were *Alternaria alternata*, *Penicillium* spp. and *Aspergillus flavus*. Of the 176 *Alternaria* isolates examined, 88.6% produced tenuazonic acid, 15.3% produced alternariol and 9% produced alternariol monomethyl ether. Only 6% of the 190 isolates of *Asp. flavus* produced aflatoxin. AA

Corn

1707

Padmanabhan (M) and Bhattacharya (M). **Planar extensional viscosity of corn meal dough.** *Journal of Food Engineering* 18(4); 1993; 389-411

Application of the entrance pressure drop method to evaluate the extensional viscosity of corn meal during extrusion cooking was investigated. An approximate planar extensional flow was generated by forcing the dough from a circular channel barrel into a slit die. The pressure drop along the contraction was calculated to obtain the entrance pressure drop ΔP_{en}. Both Cogswell's and Binding's analyses were applied to estimate the apparent planar extensional viscosity η_{pa} from ΔP_{en}. The

magnitude of η_{pa} from Cogswell's analysis was found to be much larger than that predicted by Binding's analysis. In addition, the severe extension-thinning behaviour exhibited by the fluid introduced problems in the calculations of Binding's analysis for some cases. Calculation and interpretation of the Trouton ratios have to be done carefully when extrapolation of the viscosities is required. Moderate to large entrance corrections were obtained, with lower values obtained for the lower moisture contents and temperatures of extrusion. In all cases the entrance correction decreased with increasing flow rate. AA

1708

Padmanabhan (M) and Bhattacharya (M). **Effect of extrusion processing history on the rheology of corn meal.** *Journal of Food Engineering* 18(4); 1993; 335-349

Slit and capillary dies attached in-line to an extruder are a popular configuration for obtaining the flow curves of food doughs during extrusion-cooking. However, it is demonstrated that the use of screw speed, to vary the shear rate through the die can result in erroneous flow curves for single-crew extruders. Furthermore, the use of a sidestream valve to vary the flow rate for a given screw speed is shown to result in flow curves that are different and better behaved. Such a procedure will be helpful in single-crew extruder systems, not only in obtaining the true flow curves of the food dough, but also in rheological measurements with in-line rheometers. Data for hole pressure (a measure of the first normal stress difference) are also presented to demonstrate the validity of using the sidestream valve and the error in using the screw speed to obtain rheological measurements during extrusion of starchy foods. AA

1709

Danilenko (AN), Bogomolov (AA), Yuryev (VP), Dianova (VT) and Bogatyrev (AN). **Effect of the polymerization degree, moisture content, and temperature on kinetics of hydrolysis of corn starch by α-amylase.** *Starch/Staerke* 45(2); 1993; 63-65

Corn starch hydrolysis was strongly dependent on the degree of polymerization of starch and moisture content of the system. Corn starch hydrolysis increased with increasing moisture content (max. 40%) and decreased with polymerization degree. Reaction rates increased with increasing temp. (max. 80°C). For preparation of corn starch hydrolysates, it is recommended that starch granules be subjected to grinding prior to hydrolysis and that the moisture content of raw starch is greater than 30-40%. BV

PULSES

1710

Modgil (R) and Mehta (U). **Effects of different levels of *Callosobruchus chinensis* L. infestation on proximate principles, true protein, methionine and uric acid contents of greengram and redgram.** *Journal of Food Science and Technology (India)* 31(2); 1994; 135-139

Proximate principles, non-protein nitrogen and uric acid contents in greengram (*Vigna radiata*) and redgram (*Cajanus cajan*) increased significantly with level of infestation except for calories, true protein and methionine contents decreased significantly. Since qualitative and quantitative damages to grains are related to the level of infestations consumption of higher level infested grains is not fit due to presence of insect excreta, uric acid and lack of nutritive value. SD

1711

Wiese (KL) and Jackson (ER). **Changes in calculated process times and drained weight based on soaking and blanching of kidney and navy beans.** *Journal of Food Protection* 56(3); 1993; 239-242

Effects of different soaking/blanching treatments on calculated process time (B_b) for commercial sterility of kidney and navy beans were examined. Beans were canned in 300 x 407 and 603 x 700 cans, each can receiving an equal dry wt. equivalent of beans, and B_b was determined. Effects of soaking/blanching treatments on net wt. and drained wt. were also considered. B_b for kidney beans decreased as moisture levels increased. For 2 h soaked kidney beans, compared with beans soaked for

16 h and blanched, B_b was increased in 300 x 407 and 603 x 700 cans by 9 and 46%, respectively. Drained wt. for 0 and 2 h soaked kidney beans were statistically the same, despite a 3.3-fold increase in moisture level after 2 h soaking. Blanching tended to lower B_b and drained wt. of navy beans. AA

Beans

1712

Tsuda (T), Osawa (T), Nakayama (T), Kawakishi (S) and Ohshima (K). **Antioxidant activity of pea bean (*Phaseolus vulgaris* L.) extract.** *Journal of the American Oil Chemists' Society* 70(9); 1993; 909-913

Antioxidative activity (AA) of pea bean extract and its synergistic activity with α-tocopherol were studied and purification of the antioxidant component and partial characterization of the component are described. AA was studied using a linoleic acid system, with activity being determined by the thiocyanate method. It exhibited strong AA. The extract was separated into an n-butanol phase (BP) and a water phase (WP). The WP had higher activity than the BP. In a study including α-tocopherol, the WP enhanced the AA of the tocopherol. Antioxidative fractions of the WP were purified by preparative HPLC. 5 fractions were collected, 1 with strong AA. This fraction contained 0.31 plus/minus 0.01 and 406.1 plus/minus 0.1 mg/g of phenols and sugars, respectively. The fraction had max. UV absorbance at 264.0 nm. Results indicated that the water soluble antioxidative component from pea beans may be a new type of antioxidant. BV

Locust beans

1713

Lopez da-Silva (JA), Goncalves (MP) and Rao (MA). **Viscoelastic behaviour of mixtures of locust bean gum and pectin dispersions.** *Journal of Food Engineering* 18(3); 1993; 211-228

Viscoelastic properties of single-component systems - locust bean gum (LBG), high-methoxyl (HMP) and low-methoxyl (LMP) pectins - and of HMP/LBG and LMP/LBG blends, were studied using dynamic oscillatory and steady-shear methods. Mechanical spectra of HMP/LBG blends showed characteristics intermediate between the individual components. A possible weak antagonistic interaction was found between LMP and LBG, especially in the mixture with similar amount of each single-component solution. Correlation between dynamic and steady-shear viscosities was compared with the empirical rule of Cox and Merz. Departures from the Cox-Merz rule were observed for the HMP dispersions, whereas for the LMP and the LBG dispersions, the Cox-Merz rule prediction was satisfactory. The different behaviour of LMP relative to the HMP dispersions can be attributed to the lesser extent of intermolecular association and higher hydrodynamic vol., due to the higher charge density. AA

Peas

1714

Wiege (B), Lindhauer (MG) and Bergthaller (W). **Semitechnical methods for the isolation of wrinkled pea protein.** *Starch/Staerke* 45(3); 1993; 81-84

Isoelectric precipitation and ultrafiltration were tested as semitechnical methods for the isolation of wrinkled pea protein. By aqueous extraction of wrinkled pea flour followed by centrifugation, approx. 90% of the total protein could be isolated. Using isoelectric precipitation at pH 4.4 and centrifugation by means of a separator, followed by washing and defatting steps, 65% of the protein contained in the flour was isolated from the extracted protein solution. Crude protein content of this fraction proved to be 83% in DM. Ultra- and diafiltration with a plate and frame process unit were used as alternative methods of protein separation. By diafiltration at optimized process conditions, i.e. temp., pressure and degree of concn., crude protein content of 82% DM was achieved in the concentrate. Yield of the native final product was 83%. AA

Pigeon peas

1715

Mandhyan (BL) and Jain (SK). **Optimization of machine conditions for milling of pigeon**

pea. *Journal of Food Engineering* 18(1); 1993; 91-96

The recovery of dehulled whole kernel and split kernel of 2 var. of pigeon pea [*Cajanus cajan*] was studied under various speeds and clearance in an emery roller mill. Second-order regression equations were developed and optimum conditions of clearance and speed were determined. AA

OILSEEDS AND NUTS

Gorgon nut

1716

Jha (SN) and Prasad (S). **Physical and thermal properties of of gorgon nut.** *Journal of Food Process Engineering* 16(3); 1993; 237-245

Gorgon nut (*Euryale ferox*) an aquatic herb with edible starchy kernel, requires thermal and mechanical treatment in order to remove it from the rest of the raw nut. Bulk density, true density, angle of repose, coeff. of friction on metal surfaces, specific heat, thermal diffusivity and conductivity were determined using standard techniques for different sizes of gorgon nuts at moisture contents and temp. ranging from 15 to 60% (dry basis) at 25 to 55°C, respectively. Physical properties varied quadratically with moisture content. Specific heat increased with moisture and temp. but decreased with the size of the nut; thermal diffusivity showed a reverse trend. Thermal conductivity increased with moisture content but did not follow any trend with temp. within the range of the study. Physical and thermal properties data at various moisture contents and temp. were used to develop equations for different sizes of gorgon nuts. BV

Groundnuts

1717

Mahajan (TS), Chavan (AS) and Dongale (JH). **Effect of boron on yield and quality of groundnut (*Arachis hypogaea*) on lateritic soil.** *Indian Journal of Agricultural Sciences* 64(8); 1994; 532-535

Groundnut crop grown in lateritic soil, was treated with boron at 0.5, 1.0 and 1.5 kg/ha as borax and 0.5 kg/ha as boronated superphosphate and 0.5 p.p.m. in 2 foliar sprays. Application as boronated superphosphate gave max. yield 3200 kg/ha, oil 1156 kg/ha and protein 659 kg/ha. KAR

Macadamia nuts

1718

Palipane (KB) and Driscoll (RH). **Moisture sorption characteristics of in-shell macadamia nuts.** *Journal of Food Engineering* 18(1); 1993; 63-76

Adsorption and desorption isotherms of macadamia in-shell nuts [Macadamia integrifolia] at 9 RH levels and 6 temp. ranging from 11 to 97% and 20 to 60°C, respectively, were established using the gravimetric static method. The goodness of fit of the experimental data to 4 sorption models was evaluated. Based on sorption data, the heats of adsorption and desorption as a function of moisture content were determined. The Guggenheim, Anderson and de Boer (GAB) equation with 6 constants where the monolayer moisture content also varied with temp. according to an Arrhenius-type relationship gave the best fit for both adsorption and desorption data. AA

Safflower

1719

Vasishtha (AK), Bajpai (M) and Singh (C). **Variations in the characteristics and oil compositions in different genetic varieties of safflower.** *Journal of the Oil Technologists Association of India* 26(2); 1994; 59-63

Thirty different var. of safflower analysed showed significant variations in oil, protein and glucosinolate content. Lowest oil content (26.1%) was found in var. 10-4-5-7 and the highest (39.6%) in var. 2092-84. Var. CSS-298 had the lowest protein content of 19.8% and var. 6431 had the highest protein content of 25.0%. Thioglycosides ranged between 0.5 and 3.6% in var. 10-4-5-7 and CSSI 9-1 respectively. Iodine value ranged between 138.5 and 148.7 in var. 423 and 505 respectively. GS

Soybeans

1720
Saxena (S), Gurmukh Singh and Mital (BK). **Physical characteristics and composition of certain new varieties of soybeans.** *Journal of Food Science and Technology (India)* 31(2); 1994; 145-147

Six new var. of soybean showed 7.3-8.6% hull, 0.69-0.74 g/cc bulk density, 1.05-1.18 g/cc true density, 94.3-145.6 g 1000 grain wt. and 5.6-7.6 kg hardness in vertical position and 13.0-19.8 kg in horizontal position. Colour of var. ranged from light yellow to golden yellow. The var. contained (%) 34.3-40.7 protein, 16.5-18.3 fat, 4.1-4.6 crude fibre, 4.5-5.3 total ash and 20.0-25.4 carbohydrates (by difference). The other components include (mg/100 g seeds) 247.4-307.7°Ca, 496.1-540.9 P, 10.3-13.4 Fe and 575-720 total phenols, in addition to trypsin inhibitor activity of 21.1-25.2 TUI/mg sample. AA

Soy products

Soy proteins

1721
Singh (N), Singh (D) and Chauhan (GS). **Effect of defatting, coagulants and coagulation pHs on soy protein isolates.** *Journal of Food Science and Technology (India)* 31(2); 1994; 117-121

Defatted soy flours (DSF) obtained from 4 sources (A, B, C, D) were analysed for chemical characteristics and soy protein isolate (SPI) was prepared by using different coagulants and at coagulation pHs. DSF from source B showed highest protein and ash content. DSF from source C received more heat treatment and showed comparatively lower soluble N, urease activity and trypsin inhibitor activity and higher non-enzymatic browning. SPIs made at lower pHs were whitish and softer in consistency than those made at higher pHs. The physico-chemical properties of SPIs from the DSFs varied widely. Among coagulants and coagulation pHs, HCl and pH of 4.5 produced better quality SPIs. SD

1722
Hayashi (N), Hayakawa (I) and Fujio (Y). **Flow behaviour of soy protein isolate melt with low and intermediate moisture levels at an elevated temperature.** *Journal of Food Engineering* 18(1); 1993; 1-11

The flow behaviour of moisturized (20-70% dry basis) soy protein isolate (SPI) melt at 140°C was markedly dependent on its moisture content. By regression analysis, the Herschel-Bulkley power-law model was successfully fitted to the measured data over the range gamma = 10^3 to 5 x 10^4 s^{-1}. The discontinuity of the regression coeff. observed at 41-54% dry basis moisture range suggested a difference in melt flow mechanism at opposite sides of this moisture range. At the lower moisture content (20-41% dry basis), SPI melt could flow unisotropically, but at higher moisture content (54-70% dry basis), free water could act as a lubricant. AA

Sunflower

1723
Jimenez (L) and Bonilla (JL). **Acid hydrolysis of sunflower residue biomass.** *Process Biochemistry* 28(4); 1993; 243-247

The acid hydrolysis of sunflower stalks was studied as a first step in their utilization as substrates for ethanol production. BV

TUBERS AND VEGETABLES

Cassava

1724
Abraham (TE). **Stabilization of paste viscosity of cassava starch by heat moisture treatment.** *Starch/Staerke* 45(4); 1993; 131-135

Cassava starch (CS) has poor paste stability during prolonged cooking. Starch with a moisture content of 18-24% was subjected to heat treatment (roasting, pressure cooking, oven drying, microwave heating) for 3-16 h to

improve paste stability. Optimum heat treatment for CS with 18-21% moisture content was 16 h at 110°C in an air oven. Modified starch granules were intact and had comparatively increased sedimentation vol., oil binding capacity, amylase susceptibility and decreased crystallinity, water binding capacity, solubility and paste translucency. Freeze-thaw stability of modified CS was improved. Pie filling and halwa (Indian sweetmeat) made from modified CS had good sensory properties. BV

Potatoes

1725

Shirsat (SG), Thomas (P) and Nair (PM). **Effect of γ-irradiation and CIPC treatment on processing quality of potatoes.** *Journal of Food Science and Technology (India)* 31(2); 1994; 130-134

Potato cvs (K. Badshah, K. Jyoti, K. Lavkar, Gujarat-S and Talegaon) after inhibition of sprouting by irradiation or chloroisopropyl phenyl carbamate treatment were stored at 20, 15 and 10°C upto 9 months. Processing quality of cvs was not affected at 15 and 20°C upto 6 months but storage at 10°C caused darker chips due to higher levels of reducing sugars. Potatoes stored for more than 6 months at 15°C, and reconditioning at 27-32°C or blanching improved the colour of the products cvs 'K. Jyoti', 'K. Lavkar', 'Gujarat-S'. K. Badshah with initial reducing sugar levels 310-440 mg/100 g (other cvs 120-240 mg/100 g) was not suitable for processing. *In vitro* infiltration study showed that browning was more due to glucose than fructose or sucrose. SD

1726

Wang (N) and Brennan (JG). **The influence of moisture content and temperature on the specific heat of potato measured by differential scanning calorimetry.** *Journal of Food Engineering* 19(3); 1993; 303-310

DSC was used to determine the specific heat of potato [Desiree]. Effects of temp. and moisture content on specific heat were investigated. Specific heat increased quadratically with moisture content over the range 0-4.13 (g water/g solid) and linearly with temp. varying from 40 to 70°C. A model was proposed to describe the effects of moisture content and temp. on the specific heat of potato. Good agreement was found between specific heat values determined experimentally and predicted by the model. AA

1727

Chen (DSD), Singh (RK), Haghighi (K) and Nelson (PE). **Finite element analysis of temperature distribution in microwaved cylindrical potato tissue.** *Journal of Food Engineering* 18(4); 1993; 351-368

A new finite element formulation for the analysis of temp. distribution in a microwaved potato cylinder was developed by deriving and incorporating a non-linear heat generation term for an axisymmetric and transient heat transfer problem. Using the dielectric properties of potato, temp. distribution was predicted well for centre temp. less than 80°C. The deviation between the predicted and experimental temp. greater than 80°C was corrected using the dielectric properties of water. Pronounced heating was found along the longitudinal axis passing through the centre point of the potato cylinder. AA

1728

Gorinstein (S). **Kinetic studies during enzyme hydrolysis of potato and cassava starches.** *Starch/Staerke* 45(3); 1993; 91-95

Hydrolysis of raw potato (PS) and cassava starches (CS) by bacterial α-amylase depends on action time, temp. and on the specific starch involved. The mol. wt. of commercial α-amylase (Termamyl 60L), as determined by SDS-PAGE, was 55-65 kDa; properties of α-amylase, e.g. kinetic parameters, inhibition, stability and thermostability, were studied during hydrolysis of PS and CS. K_m and V_{max} for α-amylase were fitted to Michaelis-Menten models. Initial substrate vol. at concn. 1% (w/w), temp. and reaction time were varied between 1-3 ml, 37-90°C and 5-80 min, respectively. Optimum liquified starch yields were obtained after 80 min at 80-90°C, pH 5.0-5.2. CS was more readily hydrolysed than PS at all substrate concn. CS had a much lower K_m value (2.25×10^{-3}) than potato starch.

Activation energies were 32.75 and 28.65 kJ/mol for PS and CS, respectively. BV

1729

Ollett (AL), Kirby (AR), Clark (SA), Parker (R) and Smith (AC). **The effect of water content on the compaction behaviour of potato starch.** *Starch/Staerke* 45(2); 1993; 51-55

A comparative study of treatments of the compaction and stress transmission data obtained for potato starch at different water contents in the range 5-25% (wet wt. basis) compacted in a cylindrical geometry is reported. An increase in water content leads to a greater density for a given pressure, approaching zero porosity at higher water contents. The limiting gradient of the Heckel plot, which is the reciprocal of a generalized deformation stress, decreased with increasing water content due to a plasticization mechanism. EM of granules taken from the compacts revealed greater plastic deformation at the higher water contents; the ratio of transmitted to applied stresses showed irregular variation with water content and degree of compaction. At higher water contents (> 17%), the stress ratio was, however, relatively independent of compacted height as predicted by classical semiparticulate analysis. BV

1730

Oezilgen (M). **Enthalpy - entropy and frequency factor - activation energy compensation relations for diffusion in starch and potato tissue.** *Starch/Staerke* 45(2); 1993; 48-51

Diffusion of water in hydrated starch, hydrated starch + sucrose, and diffusion of glucose, K, Mg and ascorbic acid (AA) in potato tissue (PT), i.e. a major natural source of starch, were analysed with Eyring's diffusion theory and the compensation relations. Results implied that there may be an isokinetic temp. (IT) for the diffusion of water in amioca (amylopectin, one of the major macromolecular components of starch) and hylon 7 (native corn starch). Having an IT may imply that diffusional jump occurs via formation of similar activated complexes. Although the compensation relations were satisfied, there was no IT with diffusion of water in hylon 7 + sucrose and diffusion of glucose, K, Mg and AA in PT. Therefore, the compensation relations with these 2 systems were considered only as empirical correlations for estimating diffusivities. BV

1731

Klingspohn (U), Papsupuleti (PV) and Schuegerl (K). **Production of enzymes from potato pulp using batch operation of a bioreactor.** *Journal of Chemical Technology and Biotechnology* 58(1); 1993; 19-25

Trichoderma reesei MCG77 and Rut C30 were grown on several potato pulp substrates in a stirred-tank, batch bioreactor for the production of glycosidases. Substrates used were: potato pulp (PP) consisting of starch, pectin, cellulose and hemicellulose; potato pulp residue (PR) consisting of cellulose and hemicellulose; and enzymic residue (ER) consisting of hydrolysed PR supplemented with potato pulp liquor (PPL). Avicelase, carboxymethylcellulase, xylanase and filter paper cellulase activities of the fungal fermentations were measured. Rut C30 enzyme productivities were > MCG77. Enzyme activities and productivities obtained with PR substrate were comparable to those achieved by other workers using pure cellulose substrates supplemented with a synthetic nutrient solution. Utilization of ER was 85% (w/w). An optimal operation strategy was devised to maximize enzyme production and activity. BV

Sweet potatoes

1732

Madhusudhan (B), Susheelamma (NS) and Tharanathan (RN). **Studies on sweet potatoes. II. Isolation and characterization of starch.** *Starch/Staerke* 45(1); 1993; 8-12

By differential sedimentation and centrifugation steps, 4 starch isolates were recovered from sun dried sweet potato flour and analysed. The granules in these isolates were of different size, shape and population characteristics, and were anionic in nature. They showed a single stage swelling with 30-35% solubility in water and approx. 30% solubility in DMSO after 72 h. Their starch

content varied from approx. 48 to 88%. The presence of thermostable amylases in sweet potato resulted in considerable decreases in Brabender viscosity values; amylographic studies in the presence of $HgCl_2$ showed significant increases in peak (PV) and setback (SBV) viscosities. Starch isolate I had 25% higher PV as compared to isolate II, but retrogradation was much lower in the latter. Susceptibility to glucoamylase digestion showed a decreasing trend from isolate I to IV on a solid basis, but was comparable on a starch basis. AA

Vegetables

1733

Sundararajan (R), Tamilselvan (C) and Raghunathan (R). **Residues of herbicide oxyflourfen in cabbage (*Brassica oleracea* convar capitata var. capitata), potato (*Solanum tuberosum*) and groundnut (*Arachis hypogaea*).** *Indian Journal of Agricultural Sciences* 63(1); 1993; 56-58

Three days after sowing of cabbage, groundnut and planting of potato, oxyflourfen was sprayed at 0.1, 0.2 and 0.4 kg ai/ha. 3 months after application, cabbage heads did not contain the residues, while potato tubers had highest % of residues and only traces of residues in groundnut kernels. KAR

1734

Sharma (DC) and Mahabir Singh. **Residual toxicity of insecticides on cabbage caterpillar (*Pieris brassicae*) and their dissipation on cauliflower (*Brassica oleracea* convar *botrytis* var *botrytis*.** *Indian Journal of Agricultural Sciences* 63(1); 1993; 59-63

To control the cabbage caterpillar (*P. brassicae*) cauliflower (*B. oleracea*) was sprayed in the winter season of 1988-89 wih cypermethrin (0.1125 kg ai/ha), decamethrin (0.06 kg ai/ha, fenvalerte (0.075 kg ai/ha), permethrin (0.0375 kg ai/ha), dichlorvos (0.375 kg ai/ha), endosulfan (0.525 kg ai/hja), malathion (0.375 kg ai/ha), and moanocrotophos' (0.30 kg ai/ha). Residual toxicity and dissipation were noted after the second spray. Toxicity of insecticides within 24 h of spray was in the order: decamethrin > dichlorvos > endosulfan > permethrin > cypermethrin > fenvalerate > monocrotophos > malathion. After the spray dichlorvos killed second instar larvae within 5 days; decamethrin, permethrin, fenvalerate, cypermethrin, malathion within 7 days; endosulfan within 10 days and monocrotophos within 15 days. Av. number of days required for the insecticides after spray to reach below FAO/WHO prescribed tolerance limit was 7.26, 6.55, 7.4, 6.4, 5.33, 6.35, 12.29 and 11.59 for cypermethrin, decamethrin, fenvalerate, permethrin, dichlorvos, malathion, monocrotophos and endosulfan respectively. KAR

1735

Hao (YY) and Brackett (RE). **Influence of modified atmosphere on growth of vegetable spoilage bacteria in media.** *Journal of Food Protection* 56 (3); 1993; 223-228

Six gas mixtures ($CO_2/O_2/N_2$: 0/5/95, 0/10/90, 5/10/85, 5/20/75, 10/5/85 and 10/20/70) and air were used to investigate effects of modified atmosphere (MA) on growth of 4 vegetable spoilage bacteria [*Erwinia carotovora* subsp. *carotovora* ATCC 15713, *Xanthomonas campestris* pv. *vesicatoria* ATCC-1 11551, *Pseudomonas fluorescens* 78/34 and Pepper No.15 (a pectinolytic *Pseudomonas*]). Ability of the MA to reduce spoilage in bell peppers inoculated with the respective bacteria was also studied. Growth of *Erwinia*, *Pseudomonas*, *Xanthomonas* and Pepper No.15 at 10 and 20°C was not significantly affected by the gas mixtures. At 5°C, growth of *Erwinia*, *Xanthomonas* and Pepper No.15 was slightly reduced by some gas mixtures ($CO_2/O_2/N_2$: 0/5/95, 0/10/90 and 10/5/85; 10/5/85; 0/5/95 and 10/5/85, respectively). MA containing $CO_2/O_2/N_2$: 10/5/85 did not the reduce ability of bacteria to grow at elevated NaCl concn. This MA composition did not change the % of inoculated bell peppers spoiled, but enhanced the overall visual quality. CSA

1736

Golden (DA), Rhodehamel (EJ) and Kautter (DA). **Growth of *Salmonella* spp. in cantaloupe, watermelon, and honeydew melons.** *Journal of Food Protection* 56 (3); 1993; 194-196

Ability of *Salmonella* spp. to grow on interior tissues of cantaloupe, watermelon and honeydew melons was investigated. Pieces of rind-free melon (pH 5.90-6.67) and tryptic soy broth (TSB, pH 5.90) were inoculated with a mixed culture (approx. 100 cfu/g or ml) containing equal proportions of 5 *Salmonella* spp. (*S. anatum, S. chester, S. havana, S. poona* and *S. senftenberg*). Inoculated melon pieces and TSB were incubated for 24 h at 5 or 23°C. Viable populations of salmonellae were determined by surface plating test portions on Hektoen enteric agar. Results indicated that *Salmonella* growth was rapid and prolific on melons and in TSB at 23°C. Final populations on watermelons were approx. 1.0 $\log_{10}$ > populations on cantaloupe and honeydew melons and in TSB. Although viable *Salmonella* populations on melons and in TSB did not increase during the 24 h incubation at 5°C, little or no decrease in viable populations was observed. AA

1737

Benkerroum (N), Misbah (M), Sandine (WE) and Tantaoui (E-A). **Development and use of a selective medium for isolation of Leuconostoc spp. from vegetables and dairy products.** *Applied and Environmental Microbiology* 59(2); 1993; 607-609

A selective medium (LUSM medium) for isolation of *Leuconostoc* spp. was developed. The medium contained 1.0% glucose, 1.0% Bacto Peptone (Difco), 0.5% yeast extract (BBL), 0.5% meat extract (Difco), 0.25% gelatin (Difco), 0.5% calcium lactate, 0.05% sorbic acid, 75 p.p.m. of sodium azide (Sigma), 0.25% sodium acetate, 0.1% (v/v) Tween 80, 15% tomato juice, 30 µg of vancomycin (sigma) per ml, 0.20 µg of tetracycline (Serva) per ml, 0.5 mg of cysteine hydrochloride per ml and 1.5% agar (Difco). LUSM medium was used successfully for isolation and enumeration of *Leuconostoc* spp. in dairy products and vegetables. Of 116 colony isolates obtained from fresh raw milk, curdled milk, or various vegetables, 115 were identified as members of the genus *Leuconostoc*. A total of 89 of these isolates were identified to spp.; 13.5% of isolates were *L. cremoris*, 7.9% were *L. mesenteroides* subsp. *mesenteroides*, 11.2% were *L. mesenteroides* subsp. *dextranicum*, 16.9% were *L. mesenteroides* subsp. *paramesenteroides*, 10.1% were *L. lactis*, and 40.4% were *L. oenos*. When counts obtained for 2 strains, *L. dextranicum* 181 and *L. cremoris* JLL8, on MRS agar and LUSM medium were compared, no significant differences were found between values obtained on the 2 media. AA

Tomatoes

1738

Doreyappa Gowda (IN), Ramanjaneya (KH), Anand (N), Sadashiva (AT) and Tikoo (SK). **Studies on the physico-chemical characteristics and processing quality of two IIHR tomato varieties in relation to commercial cultivars.** *Journal of Food Science and Technology (India)* 31(2); 1994; 126-129

'Arka Ashish' and 'Arka Ahuti' tomato var. were compared with 6 commercial var. They showed better fruit wt. than 'Pusa Ruby', 'Punjab Chhuhara' and 'Lerica', greater firmness than all other var. except 'Lerica', better total soluble solids than 'Pusa Ruby' and 'Roma' and better viscosity than 'Pusa Ruby', 'Roma' and 'Pusa Gaurav'. 'Arka Ashish' showed max. juice yield and lycopene content. In acidity and ascorbic acid they were comparable to other var. Puree from these 2 new var. possessed significantly higher lycopene, better viscosity and sensory quality than others. 'Lerica' and 'Pusa Gaurav' were next best var. SD

FRUITS

1739

Nwanekezi (EC), Alawuba (OCG) and Mkpolulu (CCM). **Characterization of pectic substances from selected tropical fruits.** *Journal of Food Science and Technology (India)* 31(2); 1994; 159-161

Pectin content of orange, lime, banana, mango, native mango, garden egg, avocado pear, pawpaw, cashew apple, star apple, tomato and guava fruits was studied. Mango had the highest pectin content of 1.8%, while tomato contained the lowest pectin (0.53%). The anhydrogalacturonic acid was the highest in mango, while it was the lowest in star apple.

Solubility and viscosity of the pectin were found to increase with increasing methoxyl ester content. Jams of good gelation characteristics and acceptability were produced from some of these fruits. AA

1740

Gergova (K), Petrov (N), Butuzova (L), Minkova (V) and Isaeva (L). **Evolution of the active surface of carbons produced from various raw materials by steam pyrolysis/activation.** *Journal of Chemical Technology and Biotechnology* 58(4); 1993; 321-330

A 1 step pyrolysis/steam activation was used to produce activated carbons from apricot stones, nuts, coconuts, almond shells and grape seeds, and Bulgarian lignite. Evolution of the active surface of the carbons was investigated. Results indicate that the adsorption properties of activated carbons were dependent on treatment temp., soak time and the raw materials. BV

Apples

1741

Mahajan (BVC). **Biochemical and enzymatic changes in apple during cold storage.** *Journal of Food Science and Technology (India)* 31(2); 1994; 142-144

Biochemical and enzymatic changes in apple during cold storage were studied. Total soluble solids, total sugars and soluble protein contents increased upto 150 days of storage and thereafter declined. In contrast, titratable acidity, total phenols and pectin contents followed a linear declining trend throughout the storage period of 7 months. The activity of polygalacturonase and cellulase increased upto 150 days of storage, thereby leading to softening of apple. The activities of these enzymes declined thereafter. AA

Grapes

1742

Gomez (E), Martinez (A) and Laencina (J). **Influence of SO_2 and yeast development on the evolution of C6 compounds during the first hours of vinification.** *Italian Journal of Food Science* 5(3); 1993; 263-268

The evolution of C6 alcohols and aldehydes was studied during the first hours of vinification of grapes of the cv. Cabernet Sauvignon. Likewise, the effect of various parameters such as SO_2 and yeast action was investigated. Results showed that the main C6 compounds in the must are hexanol and trans-2-hexenol. Yeasts have the greatest effect on the evolution of these compounds. AA

Jujube

1743

Ando (Y) and Takagi (T). **Micro method for stereospecific analysis of triacyl-*sn*-glycerols by chiral-phase high-performance liquid chromatography.** *Journal of the American Oil Chemists' Society* 70(10); 1993; 1047-1049

A procedure for micro stereospecific analysis (SA) of triacyl-*sn*-glycerols (TGs) by HPLC on a chiral column is presented. TGs were partially hydrolysed with ethyl magnesium bromide and total products were immediately converted to 3,5-dinitrophenylurethane derivatives. Each of the 1- and 2-monoacylglycerol (MG) derivatives was isolated by HPLC on a silica column. The 1-MGs were resolved into *sn-1* and *sn-3* MG fractions by HPLC on a Sumichiral OA-4100 column. Fatty acid methyl esters obtained from the *sn-1*, *sn-2* and *sn-3* MG fractions were analysed by GLC on a capillary column. Analyses of standard TGs showed that, even with 1 mg of sample, accuracy was comparable to that obtained with 100-mg samples. The procedure was used for SA of jujube pulp (5 mg) and rmesults confirmed the characteristic occurrence of a (n-5) series of monounsaturated fatty acids associated with jujube pulp. BV

Kiwifruits

1744

Galletti (GC), Minclone (B), Mellon (FA) and Waldron (KW). **Application of pyrolysis/gas chromatography/mass spectrometry to the analysis of kiwi mucilage.** *Italian Journal of Food Science* 5(4); 1993; 379-386

Kiwifruit (*Actinidia chinensis* Planch. var. *hispida* C.F. Liang.) mucilage was subjected to pyrolysis/GC/MS (PY/GC/MS) analysis as a practical example to show the potential of the method in the study of vegetable fibre. Pyrograms are reported for 30 pyrolysis fragments ascribed to lignin, structural polysaccharides and proteins. The behaviour of such macromolecules under PY/GC/MS is described explaining the basic principles of analytical pyrolysis with emphasis on the analysis of vegetable fibre. AA

Lemons

1745

Pifferi (PG), Manenti (I), Morselli (L) and Spagna (G). **Isolation and purification of limonin from lemon seeds.** *Italian Journal of Food Science* 5(3); 1993; 269-276

Pure limonin is needed as a substance for chromatographic reference for the quality control of citrus juices. A method is described for isolating and purifying limonin which can be easily and quickly carried out and which is capable of giving a high yield (approx. 92%). The method entails the use of acetone for continuous extraction of limonin from the dried powder of ground lemon seeds, previously defatted wth petroleum ether (60-80°C b.p.). The raw limonin obtained by diluting the conc. acetone extract with petroleum ether is then purified by reprecipitation with isopropanol from methylene chloride. The purity of limonin during extraction was determined by HPLC and TLC, using a new solvent which permitted a good resolution of the limonoids, the limonoic acids and flavonoids. AA

Mandarin orange

1746

Premi (BR), Lal (BB) and Joshi (VK). **Distribution pattern of bittering principles in kinnow fruit.** *Journal of Food Science and Technology (India)* 31(2); 1994; 140-141

Analysis of different parts of kinnow fruit showed naringin content of 0.422 mg/g in peel, 0.230 mg/ml in juice, 0.134 mg/g in seed, and limonin content of 9.52 mg/g in seed, 4.69 mg/g in peel, 0.218 mg/ml in juice. Juice stored at 25°C developed full bitterness at 4 h than that stored at 12.5°C in 7 h. SD

CONFECTIONERY, STARCH AND SUGAR

1747

Morris (VJ). **Fermentation-derived polysaccharides for use in foods.** *Journal of Chemical Technology and Biotechnology* 58(2); 1993; 199-201

Development of xanthan and gellan gums and their use in the food industry are described. Potential new bacterial polysaccharides of interest to the food industry include cyclosophorans (cyclic β(12)D glucans), acetan (a xanthan-like polymer from *Acetobacter*) and exopolysaccharides from lactic acid bacteria. BV

Starch

1748

Karathanos (VT) and Saravacos (GD). **Porosity and pore size distribution of starch materials.** *Journal of Food Engineering* 18(3); 1993; 259-280

Bulk porosity and pore size distribution were measured for granular heat-gelatinized and extruded starch materials, using helium stereopycnometry and mercury porosimetry. Most of the pores of granular materials had a radius of 1-3 μm and bulk porosity about 0.6. About 20% of the total porosity is due to the 6-8 μm voids between starch agglomerates, about 60% is due to the voids around starch granules (1-3.5 μm) and 10% is due to the very small pores. The remaining 10% of the total porosity might be due to pores larger than 150 μm. Gelatinized starches had average pore sizes of 0.8-1.5 μm and bulk porosity < 0.1. Extruded starches had pores varying from 1 to 120 μm and bulk porosity 0.1-0.95, depending on the experimental extrusion conditions. High porosity and large pores resulted when starch was extruded at high temp. and/or low moisture contents. Mechanical compression reduced bulk porosity and size of the pores.

Porosity and mean pore size of starches increased during the drying process. Porosity and pore size distribution are important parameters in the transport (diffusion) of water in starch materials and starch-based foods. AA

1749

Valle (G-D), Barres (C), Plewa (J), Tayeb (J) and Vergnes (B). **Computer simulation of starchy products' transformation by twin-screw extrusion.** *Journal of Food Engineering* 19(1); 1993; 1-31

A computer program based on a comprehensive model of co-rotating twin-screw extrusion was developed. Apart from the specific study of each section of the extruder, it allows a wide range of simulations of the complete process for starchy products. Mixing performances of kneading elements were computed. Axial profiles of filling ratio, temp., pressure and specific shear energy (computed specific energy - CSE) were predicted, and good agreement was found with experimental results and other theoretical studies where available. The program was validated for many different extrusion conditions on the basis of the comparison between computed and measured pressure and apparent viscosity at the die, specific mechanical energy and CSE. The value of CSE in predicting the transformation of starchy products is emphasized, and an example of the use of computer simulation for process scale-up is given. AA

1750

Shah (DN), Chattoo (BB), Kothari (RM) and Hegde (MV). **Starch hydrolysate, an optimal and economical source of carbon for the secretion of citric acid by *Yarrowia lipolytica* (DS-1).** *Starch/Staerke* 45(3); 1993; 104-109

Secretion of citric acid (CA) by *Yarrowia lipolytica* (DS-1) was studied as a function of carbon source, e.g. glucose, fructose, hydrol, sucrose, cane sugar molasses (CSM), kerosene (all available commercially) and taploca starch hydrolysate (TSH), invert sucrose and invert cane sugar molasses (all prepared in the laboratory). On the basis of their acceptability by DS-1 for CA and isocitric acid secretion, it is concluded that: sucrose and CSM (with/without inversion) served as poor carbon sources; fructose, hydrol, impure TSH (96 DE w/w) and invert sucrose served as relatively better carbon sources; and purified TSH (96 DE w/w) was the best carbon source to substitute glucose by giving comparable (75%) efficiency of conversion and economical advantage. BV

1751

Soni (PL), Harshwardhan (S) and Gharia (MM). **Physicochemical properties of *Quercus leucotrichophora* (oak) starch.** *Starch/Staerke* 45(4); 1993; 127-130

Quercus leucotrichophora (oak) is an evergreen tree found in Kashmir and western Himalayan regions, India. Starch from the seeds of Q. leucotrichophora was isolated, purified and its physicochemical properties determined. SEM of granules showed that they are oval to eliptical in shape. Starch had high contents of ash (1.41%), lipids (2.64%), proteins and lower contents of amylose (15.6%) compared to other starches of forestry origin. Gelatinization temp. was 80-85°C. The starch displayed high water binding capacity, low swelling capacity and high solubility. Amylograph studies showed 425 BU paste viscosity and no thinning after heating for 3 h. On cooling, starch retrograded to a paste viscosity of 1200 BU. AA

1752

Billaderis (CG), Mazza (G) and Przybylski (R). **Composition and physico-chemical properties of starch from cow cockle (*Saponaria vaccaria* L.) seeds.** *Starch/Staerke* 45(4); 1993; 121-127

1753

Slominska (L). **Studies on modification of enzymatic saccharification process.** *Starch/Staerke* 45(3); 1993; 88-90

High DE starch hydrolysates are produced in a sequence of continuous process steps (liquefaction) and discontinuous steps (bath saccharification). Batchwise saccharification requires long conversion times (48-72 h) due to the necessity for large saccharification tank vol. Glucoamylase from *Aspergillus niger* was added to maltodextrins (7.2, 14.2 and 20.8 DE) obtained from potato starch. Saccharification time of starch was evaluated at different temp.,

pH and Ca ion concn. High DE starch hydolysates were obtained after 3-4 h at 75°C, pH 4.0 with a Ca ion concn. of 50μM. BV

1754
Prokop (A) and Tanner (RD). **Foam fractionation of proteins: potential for separations from dilute starch suspensions.** *Starch/Staerke* 45(4); 1993; 150-154

Discusses the fundamentals of the separation of proteins using foaming. Thermodynamic, hydrodynamic and kinetic considerations of foam separation of protein mixtures are discussed as a guide for operating and design parameters. Ways to apply this methodology to the starch industry, particularly in the area of protein (zein) removal from starch particles, are proposed. BV

1755
Vasudeva Singh, Zakiuddin Ali (S) and Divakar (S). **^{13}C CP/MAS NMR spectroscopy of native and acid modified starches.** *Starch/Staerke* 45(2); 1993; 59-62

^{13}C CP/MAS [cross polarization magnetic angle spinning] NMR spectroscopic studies of some starches from cereals (wheat, maize and finger millet), pulses (green gram, chick pea), tuber (potato) and root (tapioca), and their respective acid (HCl, HNO_3) modifed starches, were carried out. While cereal starches exhibited a triplet signal for their anomeric carbons, pulse, tuber and root starches showed doublets. Line width changes in signals indicated that debranching in the modified starches led to narrowing of C6 signals (more pronounced in the case of potato and tapioca starches) and were consistent with the release of branching strains. Potato starch, both native and modifed, was different from other starches as inferred from the chemical shift values for their anomeric carbons and line shape. The dihedral angle (m'2) calculated from chemical shift values for C1 and conformation of dihedral angel (chi) as predicted from chemical shift of C6 are discussed with respect to structural organization. AA

1756
Aggour (YA). **Chemical modification, cross-linking and characterization of some starch hydrogels.** *Starch/Staerke* 45(2); 1993; 55-59

Modified starch hydrogels were prepared by reaction of starch with acrylamide (AAm) under certain conditions, and cross-linked with N,N'-methylenebisacrylamide (MBAAm). Rheological measurements of different ratio gels showed that increasing either the cross-linker or substrate concn. increased the elasticity of gels. The mol. wt. between 2 entanglement points (Me), was calculated from plateau modulus (Gp') values. Effectiveness of the cross-linker was calculated by comparison between the number of elastically effective points determined rheologically [ne(r)] and that obtained from theoretical values [ne(t)]. Effectiveness had a max. value of 5.76% at the higher substrate concn. of 25% (w/w) gels. Swelling of different gels was studied in pure water and in different salt solutions. Results showed that there was shrinking of gels with increasing salt concn.; however, no collapsing occurred in gels with increasing salt concn. Max. water absorption capacity was 140 g/g for 15/3 gels. AA

1757
Kennedy (JF) and Cabalda (VM). **Evaluation of an enzymic method for starch purity determination.** *Starch/Staerke* 45(2); 1993; 45-47

An enzymic method (AFNOR) for starch purity measurement was evaluated for wheat, potato and maize starches. The AFNOR method uses only a single enzyme regime consisting of amyloglucosidase (EC 3.2.1.3) from *Aspergillus niger*. The method showed incomplete conversion of some starch components (up to 2.5%) to glucose as determined by gel permeation chromatography. Degree of conversion for starches ranged between 98 and 99.6%. Negligible amounts of starch were found in precipitates/residues obtained after starch hydrolysis (< 0.1%). S.d. of the method was less than 1% for all starches studied. Results indicated that the method may not accurately measure the purity of all starches. BV

Sugar

Sugarcane

1758

Rais Ahmad and Abdul Qayyum Khan. **A formula for quick estimation of fibre in sugarcane.** *Indian Sugar* 42(12); 1993; 909-911

There are several direct and indirect methods for estimation of fibre % cane and these methods are cumbersome and time consuming. An easy and efficient formula is developed based on juice extraction % cane for quick estimation of fibre. The empirical formula is as follows: Fibre % cane = $(1-F^1)100/1.6$, where F^1 was the factor for max. available juice per unit cane derived from the equation, $F^1 = 2E-(E^2/0.84)$.E was the juice per unit cane. 0.84 was the constant for max. juice recovered at 0.1 fibre per unit cane. 1.6 represents the quantity of fibre including non-separable juice and brix free water per unit of dry fibre. The formula would be of much practical use to sugarcane researchers and sugar mills. AA

1759

Boramanikar (PK), Patil (SA) and Medhane (NS). **Effect of direct incorporation of sugarcane trash in preseasonal and ratoon crop and its effect on yield and quality of sugarcane.** *Indian Sugar* 42(12); 1993; 913-916

Sugarcane trash was directly incorporated in preseasonal and ratoon crop Co 7219 var. in 1984-86 at Pravarnagar, India and its effect on yield and quality of sugarcane studied. The treatments were along with culture (1 kg/t applied in furrows after 2 months of planting and rattoning) chopped trash at 2, 5, 8 and 10 t/ha (T_1, T_2, T_3, T_4) and unchopped trash (respective rates) (T_5, T_6, T_7, T_8) and control (no trash, no culture) (t_9). With preseasonal sugarcane, the treatments and control were comparable in sprouting % and tillering/plot, max. millable canes/plot. 225.80 was found with T_3, 227.00 with T_8; max. yield 101.00 (t/h) with T_4, 98.22 (t/ha) with T_8 and max. commercial cane sugar (CCS) 8.87 with T_1 and 11.31 (t/ha) with T_8. In ratoon crop, all the treatments and control were comparable in shoot/ha, millable cane/ha, and CCS; max. yield 93.48 was found with T_4 and 89.92 (t/ha) with T_8. SD

Sugars

1760

Ikeda (I) and Klibanov (AM). **Lipase-catalyzed acylation of sugars solubilized in hydrophobic solvents by complexation.** *Biotechnology and Bioengineering* 42(6); 1993; 788-791

Complexing glucose and other mono- and disaccharides with phenylboronic acid increased their solubility in many organic solvents. *Pseudomonas* sp. lipoprotein lipase readily acylated such solubilized sugars in these solvents. No reaction was observed without phenylboronic acid, i.e., when sugars are insoluble in the reaction medium. Solubilized D-glucose was enzymically acylated with vinyl acrylate on a preparative scale, and the resultant 6-O-acryloylglucose was chemically polymerized to yield a sugar-based polyacrylate with a mol. wt. of 14 000 Da. AA

BAKERY PRODUCTS

1761

Menon (CPS). **Importance of quality flours in baked products.** *Indian Miller* 23(5); 1993; 23-26

Typical chemical and rheological characteristics of flours for bakery products (breads and fermented crackers, biscuits and cakes) are tabulated. Their functional properties and importance in determining the quality of different bakery products are discussed. SRA

1762

Tong (CH) and Lund (DB). **Microwave heating of baked dough products with simultaneous heat and moisture transfer.** *Journal of Food Engineering* 19(4); 1993; 319-339

By using the Crank-Nicolson finite-difference method, a computer model (allowing for both variable thermal and moisture-transfer

properties) for predicting temp. and moisture contents during microwave heating was developed. The model was applied to microwave heating with both continuous and on-off power and to the cooling stage after microwave heating. A method to estimate the electric-field strength of a microwave oven was outlined and verified experimentally. Bread was chosen as the test material. The model predicted temp. very well during microwave heating and the cooling stage. It also predicted the average moisture content closely to experimental values up to 30 s of heating (within 2% error) with an electric-field strength of 42.5 V/cm. AA

1763
Ofoli (RY), Morgan (RG) and Steffe (JF). **Characterization of the swelling of starch doughs during extrusion.** *Journal of Food Engineering* 18(3); 1993; 297-312

A simple but practical model is presented for assessing the die swell of extruded food doughs for a given process history and in the absence of puffing, as a function of die geometry, shear rate and dough rheology. Since there are no simple yet effective models which account for these different phenomena, a phenomenological approach was adopted by combining parts of several models to achieve the objective of the study. The method offers 2 important advantages to die swell analysis. First, all predictions are made solely on the basis of die geometry, die temp., pressure drop across the die, and dough rheological properties, thereby correlating die swell pressure to key operating conditions. Secondly, it provides a basis for developing die swell criteria that may be useful for incorporation in process control algorithms. AA

Biscuits

1764
Kumar (KR). **Shelf life of coconut biscuit in unit and bulk packages.** *Indian Miller* 24(6); 1994; 23-29

Unit packages containing 100 g of coconut biscuits were stored individually and in bulk of 84 units (bulk packed in HDPE and in bi-axially oriented polypropylene pouches). Moisture sorption studies indicated that moisture content of 5.5% is critical with respect to acceptability of texture. Products in flexible pouches stored at (1) 90% RH, 38°C (2) 25-30% RH, 42-45°C, and (3) 65% RH, 27°C, enhanced shelf-life to 35, 90 and 180 days respectively. SRA

Bread

1765
Zanoni (B), Peri (C) and Pierucci (S). **A study of the bread-baking process. I. A phenomenological model.** *Journal of Food Engineering* 19(4); 1993; 389-398

A phenomenological hypothesis of bread baking was developed. Temp., moisture and vol. were determined during baking of a leavened bread sample. Data showed that variations in temp. and moisture of bread during baking were determined by the formation of an evaporation front at 100°C. The progressive advance of the evaporation front towards the inside of the product results in the formation of 2 separate regions: the crust, where moisture is very low and temp. asymptotically tends to the oven temp.; and the crumb, where moisture is constant and temp. asymptotically tends to 100°C. AA

Chapatis

1766
Anita Rawat, Gurmukh Singh, Mital (BK) and Mittal (SK). **Effect of soy-fortification on quality characteristics of chapatis.** *Journal of Food Science and Technology (India)* 31(2); 1994; 114-116

Soy-fortified (10%) chapatis contained 28.8% higher protein, 19.0% higher available lysine that the whole wheat chapatis and higher amounts of Ca, P and Fe than control. Soy-fortification increased PER from 1.3 to 1.7 and *in vitro* protein digestibility from 71.3 to 73.1%. Wt. of liver, heart and testis of rats fed on soy-fortified chapati were significantly higher than those with control diet. Soy-fortified chapatis retained 13% of the trypsin inhibitor activity and were softer. SD

1767

Gupta (TR). **Thermal conductivity of Indian unleavened flat bread (Chapati) at various stages of baking.** *Journal of Food Process Engineering* 16(3); 1993; 227-235

A steady state technique was used to measure thermal conductivity of whole wheat dough (for production of rolled chapatti) and baked chapatti (round disc prepared mostly from whole wheat flour dough) at various stages of cooking. Based on the experimental data of chapatti at various stages of cooking, a linear equation $K = -0.5677 + 0.01396 M + 0.005131 T$ is proposed for conductivity of wheat flour dough and baked chapatti at moisture levels (M): $35 < M < 50\%$ [wet basis] and temp. ranges $35 < T < 60^{\circ}C$. A separate equation $K = 0.3204 + 0.0091 M - 0.00805 T$ predicts thermal conductivity of rolled chapatti and baked chapatti at $T > 60^{\circ}C$. AA

Pasta

1768

Resmini (P), Pellegrino (L), Pagani (MA) and de Noni (I). **Formation of 2-acetyl-3-D-glucopyranosylfuran (glucosylisomaltol) from nonenzymatic browning in pasta drying.** *Italian Journal of Food Science* 5(4); 1993; 341-353

The presence of 5-hydroxymethyl-2-furaldehyde (HMF) in dried pasta was investigated. Other soluble components produced by the advanced Maillard reaction and related to pasta drying were also determined. On the basis of both experimental data and the conditions known to regulate nonenzymic browning, there was found to be a lack of or trace amounts (less than or equal to 0.1 p.p.m.) of HMF in commercial dried pasta. Another water-soluble furanic compound arising from the advanced Maillard reaction between maltose and free amino acids, glucosylisomaltol (chemically 2-acetyl-3-D-glucopyranosylfuran (AGPF), was identified and quantified in pasta by ion-pair reversed-phase HPLC. Being negligible in spaghetti dried under low or medium temp. conditions, AGPF formation proved to be related both to the severity of thermal processing and the availability of free amino acids, mainly glutamine. A relationship was found between the amount of AGPF and redness that develops in pasta dried under either experimental or industrial conditions. Taking into account the reported characteristics of the AGPF precursor, 1-deoxyhexosulose, the extent of this type of advanced Maillard reaction may explain undesirable sensorial changes which sometimes appear in high-temp. dried pasta. AA

MILK AND DAIRY PRODUCTS

1769

Khanna (RS). **Indian dairying: Introspection and opportunities.** *Indian Dairyman* 46(4); 1994; 152-159

The problems of Indian dairy industry; implementation of milk and milk products orders; co-operatives versus private sector; need for subsidies, development cess; strength, weakness, opportunities and threats of the dairy sector; demand for dairy equipment for the manufacture of ice cream, milk shakes, milk and whey powders and cheeses are discussed. GS

1770

Nirula (L). **Investment opportunities in Indian dairying.** *Indian Dairyman* 46(4); 1994; 180-183

Contends that in an Indian dairy industry, quality consistency and innovation are the key requirements to provide total satisfaction with regard to quality, quantity and price to the consumer. GS

1771

Mahadevan (AP). **Marketing opportunities within the country.** *Indian Dairyman* 46(4); 1994; 186-189

Outlines the factors that govern dairy marketing such as growth in population in numbers and in its purchasing power; technological progress on processing, material science and packaging; increasing consumer awareness; and insistence on the quality by the

manufacturer, consumer and the regulating agencies. Milk utilisation pattern in India, procurement and marketing of milk, projection of milk consumption and production capacity of milk powder are also projected. GS

1772

Banerjee (RP). **Indian dairy equipment scenario.** *Indian Dairyman* 46(4); 1994; 190-191

Lists out sophisticated equipments available in the Indian dairy industry such as electronic milk tester, evaporating and drying plant, cream separator, plate heat exchanger, homogeniser (small), small capacity packing machine, instruments and controls, bulk vending units and rail/road milk tankers; and know-how to take responsibility for integrated milk projects. Stresses the need for research in the design and development of new equipments like large capacity homogenisers UHT plant, reverse osmosis, ultrafiltration, aseptic packaging machine, packing machine for cheese, butter and ice cream. GS

1773

Pandit (SD) and Rao (CS). **Emerging dairy equipment scenario - I.** *Indian Dairyman* 46(4); 1994; 192-197

The change in the concept and content that have taken place in the dairy equipment industry which facilitate the collection, transportation, processing, pasteurisation, standardisation, separation, homogenisation, automation, powder manufacture, evaporation, pre-heating system, mechanical vapour recompression, spray drying and packaging of milk are covered. GS

1774

Keshavdas (NJ). **Emerging dairy equipment scenario - II.** *Indian Dairyman* 46(4); 1994; 198-200

The dynamic changes in the dairy equipment industry for clean milk production, process continuity, process automation, larger handling capacities, new innovative dietary products, improved product standards, aspetic processing of milk products and packaging systems, indigenous milk products and thrust in R and D activities are covered. GS

1775

Upadhyaya (RL). **Global dairy equipment scenario.** *Indian Dairyman* 46(4); 1994; 202-203

The impact of de-regulation and global economy on Indian economy and the dairy industry equipment manufacturing sector is described. GS

1776

Phelan (J). **Globalisation of dairy research, education and training.** *Indian Dairyman* 46(4); 1994; 204-208

Outlines the attempts made in India for promoting dairy research, education and training and evaluates its adequacy in the global scenario. GS

1777

Hartel (RW) and Chung (MS). **Contact nucleation of ice in fluid dairy products.** *Journal of Food Engineering* 18(3); 1993; 281-296

For freeze concentration processes involving suspension crystallizers, contact (secondary) nucleation of ice crystals may be an important mechanism of formation of nuclei. The critical subcooling required before stable secondary nuclei form is an important design parameter for such freeze concentration systems. Critical subcooling for secondary nucleation of ice in aqueous sugar solutions and fluid dairy products [whey extract, whey powder, skim milk made from non-fat dried milk and store-purchased skim milk] were determined using 2 experimental techniques. The method of observation (experimental technique), type of solution studied and its concn. were found to affect the critical subcooling temp. Of all the components in these solutions, whey protein was the main factor in determining critical subcooling temp. Critical subcooling increased linearly with whey protein content. AA

1778

Hammack (TS), Satchell (FB), Andrews (WH), Amaguana (RM), June (GA), Sherrod (PS), Koopman (L). **Abbreviated preenrichment period for recovery of *Salmonella* spp. from selected low-moisture dairy foods.** *Journal of Food Protection* 56(3); 1993; 201-204

A 6 h and a 24 h preenrichment procedure were compared for their ability to recover *Salmonella* spp. from selected low moisture dairy products [instant dried nonfat milk, non-instant dried non-fat milk, dried whole milk, lactic casein and rennet casein]. Foods were artificially inoculated several days before analysis and 20 replicate test portions per procedure from each food were examined in each experiment. Samples examined by the 6 h abbreviated procedure were preenriched for 6 h at 35°C in an air incubator or water bath and centrifuged at 4100 x g for 10 min. Pellets were suspended in tetrathionate broth and incubated for 24 h at 35°C. For the 24 h standard procedure, test portions were preenriched for 24 h at 35°C in an air incubator, subcultured to tetrathionate broth and incubated for 24 h at 35°C. Selective enrichment broths from both procedures were streaked onto selective agar plates, and presumptive Salmonella isolates were identified by conventional biochemical and serological tests. Recovery of *Salmonella* spp. from instant dried non-fat milk and dried whole milk was equivalent for both preenrichment procedures. Relative effectiveness of the 2 procedures varied in the recovery of *Salmonella* spp. from non-instant dried non-fat milk, lactic casein and rennet casein. AA

Milk

1779

Mittal (SP). **Competitiveness of Indian milk production.** *Indian Dairyman* 46(4); 1994; 160-162

Milk production in India is done by small un-organised farmers who do not have the knowledge of the cost of production. Hence, modernisation of Indian dairy industry in milk processing, product manufacturing and marketing are recommended. Using low cost feed and labour, Indian dairy industry can improve its efficiency and face the increasing competition in the international market. GS

1780

Gill (RS). **Competitiveness of Indian milk production: Another view.** *Indian Dairyman* 46(4); 1994; 164-167

The competitiveness of Indian milk production is viewed from different angles viz. price, quality, packaging quality and marketing effectiveness. Need to have correct estimates of production of milk and various milk products with their costs and market prices, is emphasised. GS

1781

Mahendra Singh. **Impact of liberalisation on milk producers.** *Indian Dairyman* 46(4); 1994; 168-173

The implications following liberalisation and General Agreement on Tariffs and Trade on Indian dairy industry and its possible favourable impacts are discussed. GS

1782

Bhasin (NR). **Impact of GATT on milk producers.** *Indian Dairyman* 46(4); 1994; 174-178

The positive and negative impacts of General Agreement on Tariffs and Trade on milk producers such as affecting the national economy; business of milk production and economics of other agricultural commodities are discussed. GS

1783

Charan (R) and Prasad (S). **Energy conservation in milk spray-drying plant.** *Journal of Food Engineering* 18(3); 1993; 247-258

A mathematical model for the energy consumption in spray-drying plant was developed. The model was tested using data collected from a commercial milk spray-drying plant producing 1500 kg/h baby food. Operating parameters were optimized using the gradient projection method for a multi-variable non-linear function subject to inequality

constraints. Energy consumption of the milk drier was compared using the existing and optimized systems. It was found that there was a saving of 16.8% in the total energy consumption. AA

1784

Pagliarini (E), Solaroli (G) and Peri (C). **Chemical and physical characteristics of mare's milk.** *Italian Journal of Food Science* 5(4); 1993; 323-332

Data on the chemical composition and physical properties of mares' milk are presented. A comparison between these data and those obtained for cows' milk shows that levels of fat and cholesterol in mares' milk are about one third those in cows' milk. The ratio of unsaturated to saturated fatty acids is 1.32 (0.45 for cows' milk), and the ratio of polyunsaturated to monounsaturated fatty acids is 0.83 (0.08 for cows' milk). 50% of the protein fraction consists of whey proteins, and the lysozyme content (11%) is very high. Mares' milk has a very high vitamin C content and a low mineral content. The Ca/P ratio is 1.7, which is very close to the optimal value for calcium assimilability. AA

1785

Macri (A), Brambilla (G), Civitareale (C) and Bocca (A). **Multiresidue method for isolation and determination of eight benzimidazole anthelmintics in cow milk.** *Italian Journal of Food Science* 5(3); 1993; 239-245

Reports a multiresidue method using HPLC with a UV diode array detector to estimate, in routine analyses, the presence of 8 benzimidazole anthelmintics (albendazole, fenbendazole, febantel, mebendazole, oxibendazole, oxfendazole, parbendazole and thiabendazole) in cows' milk. Milk (10 ml), freeze-dried overnight, was alkalized with 10N NaOH and extracted with organic solvents (ethyl acetate-methylene chloride (2:1) and hexane-acetonitrile (1:2)). The extract was dried, redissolved in 100 mul of mobile phase (0.017M phosphoric acid adjusted to pH 3.0 with diethylamine-acetonitrile) and injected onto an RP C18 column. The limit of determination was 10 p.p.b. for the drugs considered, i.e. the Maximum Residue Level fixed by the EEC for some of these drugs (febantel, fenbendazole and oxfendazole) in milk. Recovery rates for the drugs spiked in milk ranged from 63.4 plus/minus 5 to 97.0 plus/minus 3%. AA

1786

Lopez (F-R), Corzo (N), Villamiel (M), Delgado (T), Olano (A), Ramos (M). **Assessment of quality of commercial UHT milks by chromatographic and electrophoretic methods.** *Journal of Food Protection* 56(3); 1993; 263-264, 269

Forty four samples of commercial UHT milk were analysed within 15 days of processing for detn. of lactulose, undenatured whey proteins, furosine and proteolysis of caseins as quality indicators for setting legal standards for commercial-heat processed milk. Some UHT milks, containing suggested levels of lactulose (< 600 mg/l) and β-lactoglobulin (> 20 mg/l), showed high levels of casein degradation. Samples which appeared overprocessed, from their lactulose and β-lactoglobulin contents, also contained large amounts of para-kappa-casein which could indicate a poor microbiological quality of raw milk causing protein degradation prior to UHT processing. CSA

1787

El Marrakchi (A), Hamama (A) and El Othmani (F). **Occurrence of *Listeria monocytogenes* in milk and dairy products produced or imported into Morocco.** *Journal of Food Protection* 56 (3); 1993; 256-259

Examination of 227 samples of milk and dairy products *L. monocytogenes*. showed that raw and pasteurized milk and some traditionally prepared Moroccan dairy products such as fermented milks (lben and raib), fresh cream, traditional fresh cheese (jben) and locally made or imported ripened cheeses (Camembert, Brie, Blue) were contaminated with pathogens. Results of the study also indicated that Lben, raib and jben were all contaminated with *L. monocytogenes*. The only other *Listeria* sp. isolated was *L. innocua*, isolated from jben. *L. monocytogenes* was not detected in pasteurized milk, fresh cream or fresh and ripened (industrially prepared) cheeses. CSA

Milk products

Cheese

Cheddar cheese

1788

Grazier (CL), Simpson (R), Roncagliolo (S), Bodyfelt (FW) and Torres (JA). **Modelling of time-temperature effects on bacteria populations during cooling of Cheddar cheese blocks.** *Journal of Food Process Engineering* 16(3); 1993; 173-190

Differences in cooling rate of Cheddar cheese from pressing (35°C) to ageing temp. (3.5-12°C) have been reported to be responsible for flavour variation within a production lot. During ageing, starter and nonstarter bacteria contribute extensively to flavour quality; excessive growth of nonstarter bacteria leads to undesirable flavour characteristics. Temp. effects on [starter and nonstarter lactic acid] bacteria were quantified using cheese from a local processor [during storage at 5-35°C]. At day 1, starter counts were 8×10^7 cfu/g but as ageing continued, starter counts decreased and nonstarters became dominant. At 35°C, starter counts reached 3×10^8 cfu/g by day 3 and were $< 10^8$ cfu/g by day 5. At 25, 20, 15 and 12°C, starter bacteria were $< 10^6$ cfu/g by day 10, 20, 24 and 40, respectively. Nonstarter counts, initially 10^4 cfu/g, reached approx. 10^8 cfu/g in increasingly shorter times with higher temp. Kinetic analysis of [microbial] growth [during cooling] in cheese and in a liquid medium suggested the possibility of diffusion growth limitations in cheese. Computer simulation for the growth of nonstarters suggests that individual cooling of small blocks (18 kg) would reduce the contribution of nonstarter counts to Cheddar cheese ageing. AA

Mozzarella cheese

1789

Molo (L), Langlois (D), Etievant (PX) and Addeo (F). **Powerful odorants in water buffalo and bovine Mozzarella cheese by use of extract dilution sniffing analysis.** *Italian Journal of Food Science* 5(3); 1993; 227-237

Mozzarella cheese made from either water buffaloes' milk or cows' milk was analysed by extract dilution sniffing analysis using a technique best known as CharmAnalysisRegistered. 24 impact aroma compounds were screened in water buffaloes' milk Mozzarella cheese and 16 in cows' milk Mozzarella cheese. The most active aroma compounds of water buffalo Mozzarella cheese were 1-octen-3-ol (raw mushroom, undergrowth, and/or musk), nonanal (tallowy and/or animal), indole (stable) and an unidentified component characterized by a typical aroma of truffles. These 4 compounds together represent greater than 50% of the total aromatic profile. Ethyl isobutanoate and ethyl 3-methylbutanoate, characterized by a green aroma and that of unripe fruit and fresh cheese and/or cheese factory, respectively, represent the impact aroma compounds in cows' milk Mozzarella cheese. The differences observed between the impact compounds of water buffalo and cows' milk Mozzarella cheeses probably justify the sensory differences between water buffalo and cows' milk Mozzarella cheeses. AA

1790

Molo (L), Dekimpe (J), Etievant (PX) and Addeo (F). **Comparison of the neutral volatile compounds in Mozzarella cheese made from bovine and water buffalo milk.** *Italian Journal of Food Science* 5(3); 1993; 215-225

Volatile compounds in bovine's milk Mozzarella cheese were isolated using vacuum distillation followed by continuous liquid-liquid extraction. The extract was analysed by means of high resolution capillary GC and GC-MS. 80 compounds were identified and 61 quantified. They included alcohols (46%), esters (14%), ketones (6%), aldehydes (8%), nitrogen compounds (11%), sulphur components (0.1%), aromatic hydrocarbons (4%) and lactones (9%). Aroma of the individual components was assessed using a GC equipped with a sniffing port. The main differences between cows' milk and water buffaloes' milk Mozzarella cheeses were in the levels of: esters, which were 10x higher in cows' milk cheese; ketones, which were present in smaller amounts in cows' milk cheese (6 vs. 50% of the total neutral volatile fraction); aldehydes and

nitrogen compounds, which were approx. half those of buffaloes' milk cheese in cows' milk cheese; and alcohols and lactones, which were higher in cows' milk cheese. Several esters were detected in cows' milk Mozzarella cheese only. Data confirm previous suggestions that the aroma of a fresh cheese, even in the case of a pasta filata cheese, is partly related to the aroma of the milk used for its manufacture. AA

Ice cream

1791

Bharath Bhushan Reddy (B), Kotilinga Reddy (Y), Ranganadham (M) and Padmanabhan Reddy (V). **Bacteriological quality of ice cream marketed in Tirupati, a pilgrimage town of India.** *Journal of Food Science and Technology (India)* 31(2); 1994; 151-152

Counts of mesophilic aerobes, coliforms, aerobic spore formers and staphylococci in market samples of ice cream varied in relation to the sources and packages. Higher counts of coliforms were prevalent in samples collected from local vendors. Ice cream samples from parlours and hotels showed higher staphylococcal counts. With reference to the packages, ice cream sold in cups had higher counts of coliforms and staphylococci, while aerobic spore formers were on a higher side in ice cream bars. AA

Whey

1792

Meenakshi Rani and Verma (NS). **Effect of soymilk supplementation on the coagulation time, green cheese composition and losses of milk components in whey.** *Journal of Food Science and Technology (India)* 31(2); 1994; 156-158

Results indicated that the cow milk (CM) was higher in total solids (TS), fat, acidity and ash contents, except for proteins, as compared to soy milk (SM) or the blends made therefrom. Addition of SM to CM resulted in an increase in clotting time 274, 381, 559, 738 and 906 sec, respectively of different blends (95:5, 90:10, 85:15, 80:20 and 75:25) of CM and SM yield and titratable acidity of whey decreased with the increase in proportion of soy solids in blend, whereas reverse was true for the TS, protein and ash. The yield of cheese increased with increase in the proportion of soy solids in the blend. The moisture content of cheese made from CM using enzymes was similar, but it increased with the increase in the soy solids in the blends. A slight decrease in protein and fat cheese made from various cow:soy milk blends with the microbial rennet was observed. A slight increase in salt content was found in cheese made with higher soy solids in the blend. Increase in titratable acidity, soluble protein and free fatty acid values of cheese were also observed with increases in proportions of soy solids in the cow:soy milk blends. BV

1793

Belmar (BMT), Gotham (SM), Paterson (WR), Fryer (PJ) and Pritchard (AM). **The effect of Reynolds number and fluid temperature in whey protein fouling.** *Journal of Food Engineering* 19(2); 1993; 119-139

Food fouling is a severe industrial problem. Both the chemistry and fluid mechanics of fouling from milk fluids are complex. Experiments were conducted in a tubular heat exchanger to determine whether fouling from whey protein concentrates is controlled by a bulk or a surface reaction. Results are interpreted in terms of a simple model, in which the amount of deposit is considered to be proportional to the vol. of fluid that is hot enough to produce denatured and aggregated protein. The model fits the data reasonably well and suggests bulk processes are important in whey protein fouling. AA

1794

Koutake (M), Matsuno (I), Nabetani (H), Nakajima (M) and Watanabe (A). **Osmotic pressure model of membrane fouling applied to the ultrafiltration of whey.** *Journal of Food Engineering* 18(4); 1993; 313-334

An osmotic pressure model for membrane fouling was investigated for predicting flux behaviour during ultrafiltration of reconstituted whey solutions, using a membrane of mol. wt. cut-off value of 20 000 Da. Estimations of flux were conducted for 3 solutions: whey protein, whey protein + lactose and reconstituted whey, using physical

properties of whey protein and lactose measured or obtained from published papers. Estimated fluxes of whey protein and whey protein + lactose solutions compared closely with measured values. Concerned with concentration polarization, this model made it clear that operating pressures were reduced mainly by the osmotic pressure of lactose rejected by the fouled membrane, not of whey protein. In the range of usual operating pressures (0.1-0.4 MPa), fouling was an important factor of flux decline for ultrafiltration of whey + lactose solution. Thus, a less fouling membrane is preferable. AA

MEAT AND POULTRY

Meat

1795

Knudtson (LM) and Hartman (PA). **Comparison of fluorescent gentamicin-thallous-carbonate and KF streptococcal agars to enumerate enterococci and fecal streptococci in meats.** *Applied and Environmental Microbiology* 59 (3); 1993; 936-938

Two selective and differential media were compared for their abilities to enumerate enterococci and faecal streptococci in pork, beef and poultry products. Counts obtained on KF streptococcal (KF) agar were compared with counts obtained on fluorescent gentamicin-thallous-carbonate (fGTC) agar. Reactions of 13 known enterococcal spp. were also observed. All 13 spp. of enterococci as well as *Streptococcus bovis* and *S. equinus* grew equally well on fGTC agar. KF streptococcal medium allowed growth of most spp. of enterococci but not *S. bovis* and *S. equinus*. Quantitative comparisons between the 2 media inoculated with pure cultures of known spp. of enterococci revealed equivalent plate counts following incubation. However, when meat samples were plated, counts on fGTC agar were consistently and significantly higher than counts on KF agar for all sample sources. AA

Beef

1796

Vermeulen (P), Urrestarazu (V), Huertas (S), Baltar (J) and Brum (JJ). **Organoleptic qualities and foot-and-mouth disease virus stability in beef patties processed by broiler/continuous belt oven cooking.** *Journal of Food Protection* 56(3); 1993; 219-222

Commercial processing methods routinely used for cooking ground beef patties in the United States were examined for their virucidal activity against foot-and-mouth disease (FMD) virus. To study virucidal activity of the processes, 10 g of the patty centre were replaced with FMD virus infected lymph node tissue prior to processing. Processing involved passing the patties through a broiler and then oven cooking for 0, 5, 10, 15 or 20 min. Cooking patties for 20 min after broiling, giving them an exit temp. of 99.7°C, inactivated greater than 4.0 log10 pfu of FMD virus. Sensory analysis of products which had been prepared using the virucidal process showed the process yielded consumer-acceptable products. AA

1797

Fernandez (E-E), Saldana (L-J) and Rodriguez (G-O). **Fate of *Salmonella* in salpicon, a Mexican cold shredded beef salad.** *Journal of Food Protection* 56(3); 1993; 197-200

Pork

Pigs

1798

Kotula (AW) and Sharar (AK). **Presence of *Yersinia enterocolitica* serotype O:5,27 in slaughter pigs.** *Journal of Food Protection* 56(3); 1993; 215-218

The tonsils, tongue, mesentric lymph nodes, caecal contents and faeces from 50 slaughter pigs were evaluated for the presence of pathogenic serotypes of *Y. enterocolitica* strains. The caecal contents and faeces of 2 pigs (4%) were positive for serotype O:5,27, biotype 3, whereas all other pigs were negative for pathogenic serotypes of *Y. enterocolitica*. This serotype has been reported to cause yersiniosis in humans. Results suggested that measures should be taken to detect and control the spread of the organism. CSA

Products

1799
Zanoni (B), Peri (C), Pierucci (S) and Barattini (A). **Predictive modelling of Bologna sausage cooking.** *Italian Journal of Food Science* 5(4); 1993; 311-322

A model was developed to describe heat and mass transfer phenomena during cooking of cylindrical Bologna sausages under varying temp. conditions. The model was solved by a finite difference numerical method. Validation experiments demonstrated that the model adequately simulates temp. and absolute moisture profiles at each point of the product and the total mass loss. This model was then applied to predictive bacteriology. The number of microorganisms at each point of the product and at each stage of the process was evaluated by combining the heat and mass transfer model and equations of microbial growth and destruction. The kinetic constants used in the model were taken from literature data on thermoresistant Enterococcus strains. This approach could be considered for future research on process control and optimization. AA

Poultry

1800
Nath (RL), Mahapatra (CM) and Singh (JN). **Avian muscle and its relevance to meat industries.** *Poultry Guide* 31(8); 1994; 25-30

Need for further research on the aspects of electrical stimulation method for improving poultry meat quality; predicting the effects of ingredients and processing variables on cook yield; development of decolourization process for using red meats in white meat products; and control of pH of the comminuted meat to maximize functionality during processing are discussed. GS

1801
Bellomonte (G), Filesi (C), Macri (A), Mosca (M) and Sanzini (E). **High performance liquid chromatographic determination of nitrofurans and free chloramphenicol in poultry muscle, liver and eggs.** *Italian Journal of Food Science* 5(3); 1993; 247-253

Nitrofurans and chloramphenicol are used extensively in the poultry industry and their residues in meat and eggs are a worldwide health concern. An HPLC procedure was developed for the analysis of nitrofurazone, furazolidone, furaltadone and free chloramphenicol residues in poultry meat, liver and eggs. The limit of quantitation (LOQ) of this method was 2 p.p.b., except for chloramphenicol in liver for which the limit of quantitation was 10 p.p.b. Recoveries from fortified samples ranged from 88 to 95%. The assay required small amounts of sample and reagents, it was sensitive, had high recoveries, and can be used to determine residues from both nitrofurans and chloramphenicol in a variety of matrices. AA

Chickens

Broilers

1802
Samanta (M) and Biswas (P). **The use of lactic acid in broiler production.** *Poultry Guide* 31(8); 1994; 53-54

Probiotics is the new addition as growth promoter in poultry production. At 0.25% level they produce lactic acid, lowering internal pH and beneficial effects in broilers such as wt. gain, better feed conversion, reduced mortality and higher carcass yield. GS

1803
Macri (A), Valfre (F), Pieramati (C), Pierdominici (E), Achene (L), Ioppolo (A). **Effect of clenbuterol on broiler chickens under intake restriction.** *Italian Journal of Food Science* 5(3); 1993; 255-262

Experiment was conducted on broiler chickens to establish whether the repartitioning effect of the β-agonist clenbuterol (0.5, 1 and 2 p.p.m.) is present in severe intake restriction conditions (about 50% of [the National Research Council] NRC estimated daily intake). Clenbuterol had a positive effect on body wt. gain; the repartitioning effect was also present.

Carcass wt. increased more than live wt., and superficial pectoral muscle wt. increased more than carcass wt. Carcass fat decreased up to 2.8% and carcass protein increased up to 4.1%, both on DM basis. AA

Products

Eggs

1804
Marolia (KZ) and D'Souza (SF). **Removal of glucose from hen egg using glucose oxidase and catalase co-immobilized in hen egg white foam matrix.** *Journal of Food Science and Technology (India)* 31(2); 1994; 153-155

A novel technique has been developed for obtaining a porous hen egg white foam matrix containing co-immobilized glucose oxidase and catalase. The technique involved cross-linking of the foamed egg white along with the enzymes using 0.75% glutaraldehyde for 1 h. The foamed matrix was mechanically very stable and could be reused in 10 batches for the removal of glucose from eggs, without loss in activity. AA

SEAFOODS

1805
Cormier (A), Chiasson (S) and Leger (A). **Comparison of maceration and enumeration procedures for aerobic count in selected seafoods by standard method, PetrifilmRegistered, RedigelRegistered, and Isogrid.** *Journal of Food Protection* 56(3); 1993; 249-251, 255

Two methods of macerating samples, manual shaking and homogenizing in a Waring blender, were compared for 12 replicates of raw clams, raw cod, cooked lobster and cooked shrimp. 3 commercial aerobic count detn. methods, Isogrid, Redigel™ and Petrifilm™, were compared with the standard aerobic plate count method for raw cod, raw mussels and frozen cooked shrimp. Counts obtained for maceration by manual shaking were highly correlated (r = 0.98) with those obtained after maceration by the blender homogenization method. Compared with conventional blender homogenization, the manual shaking technique gave recoveries of 98.2% for clams, 99.7% for cod, 101.6% for lobster and 97.2% for shrimp. No significant differences were found between the 4 enumeration methods. Correlation coeff. obtained by plotting $\log_{10}$ cfu/g for 1 enumeration method against a 2nd method ranged from 0.86 to 0.99. Counts obtained with the 3 commercial methods were from 97.6 to 104.0% of the counts obtained by the standard method. The Isogrid, Redigel™ and Petrifilm™ methods are suitable alternatives to the conventional standard plate count method for aerobic counts detn. in sea foods. AA

Mussels

1806
Soto (M), Mendez (R) and Lema (JM). **Sodium inhibition and sulphate reduction in the anaerobic treatment of mussel processing wastewaters.** *Journal of Chemical Technology and Biotechnology* 58(1); 1993; 1-7

Oyster

1807
Jawahar Abraham (T), Balasundari (S), Indra Jasmine (G) and Jeyachandran (P). **Influence of antioxidants on the sensory quality and oxidative rancidity of frozen edible oyster.** *Journal of Food Science and Technology (India)* 31(2); 1994; 168-170

Sensory acceptability and oxidative rancidity of antioxidant-treated edible oyster, frozen at -40°C and held under frozen storage (-18°C) condition, were investigated. The sensory acceptability declined steadily during storage and was accompanied by an increase in the oxidative rancidity of the product. Untreated and butylated hydroxy toluene (0.2% w/w) treated samples developed dark discolouration after 2 months of storage. Addition of clove powder (0.20% w/w) significantly reduced the oxidative rancidity, measured as thiobarbituric acid reactive substances, and improved the sensory acceptability of the product. AA

1808

Atmar (RL), Metcalf (TG), Neill (FH) and Estes (MK). **Detection of enteric viruses in oysters by using the polymerase chain reaction.** *Applied and Environmental Microbiology* 59(2); 1993; 631-635

A procedure for detection of enteric viral nucleic acid in oysters by PCR was developed. Known quantities of poliovirus type 1 were seeded into oysters. Virus was extracted and concentrated by using organic flocculation and polyethylene glycol precipitation. Inhibitors of reverse transcription-PCR were present in oyster extracts, preventing amplification of target viral nucleic acid. Cetyltrimethylammonium bromide precipitation removed inhibitors sufficiently to allow detection of as few as 10 pfu of poliovirus. Norwalk virus could also be detected after being seeded into oysters. This methodology may be useful for the detection of these and other shellfish-borne viral pathogens. AA

Prawns

1809

Jawahar Abraham (T) and Jeyachandran (P). **Studies in microorganisms associated with prawn pickle.** *Journal of Food Science and Technology (India)* 31(2); 1994; 165-167

Microorganisms associated with prawn pickle, stored at ambient temp. (30 plus or minus 2°C) were studied for 270 days at regular intervals. A decrease in total viable count up to 60 days and a slight increase thereafter were observed. *Bacillus* spp. were the dominant group comprising more than 50% of the total population, followed by *Micrococcus* spp. The population of anaerobic spore-formers increased with the increase in storage period. All the bacterial isolates were positive for lipid hydrolysis, while only *Bacillus* spp. were able to liquefy gelatin. The initial bacterial flora were sensitive to low pH and higher salt levels, in contrast to higher salt and acid tolerance by the surviving bacterial flora during storage. AA

Shrimps

1810

Thomas (F) and Iyer (TSG). **Indole an index of decomposition in shrimp.** *Seafood Export Journal* 25(18); 1994; 23, 27

Levels of indole are used as indicators of decomposition in the seizure of frozen sealed shrimp. Indole content in the frozen shrimps exported from India are within permissible limits, viz., 25 μ/100 g as fixed by importing countries. GS

Fish

1811

Bhaskaran Nair (P). **ISO 9000 quality system for fish- and fishery products - an introduction to basic concepts.** *Seafood Export Journal* 25(17); 1994; 35, 37, 39, 41, 43

Basic concepts and structure of ISO 9000 quality system standards for fish and fishery products are described. Cross reference list of quality system elements comparing ISO 9001, 9002, 9003 and 9004 is also provided. GS

1812

Bhattacharya (S), Das (H) and Bose (AN). **Effect of extrusion process variables on the product texture of blends of minced fish and wheat flour.** *Journal of Food Engineering* 19(3); 1993; 215-235

Effects of extrusion process variables (such as length/ diam. (L/D) ratio of extruder, feed ratio (ratio of fish solids and wheat flour), temp. of extrusion and screw speed) on product texture, obtained by extrusion of blends of partially dried low-cost minced fish [Bombay duck, Harpodon nehereus] and wheat flour were studied. A single-screw variable-length cooling extruder, with a barrel bore of 25 mm, was developed for this purpose. Heat stability of cooked extruded rods in boiling water was assessed. The texture parameters (hardness, springiness and cohesiveness) of cooked rods were determined and compared with those of cooked fish, with the objective of developing a fish analogue using extrusion cooking. Among the process variables, an increase in L/D ratio or feed ratio increased texture parameters; effects of extrusion temp. and screw speed on

texture parameters were complex in nature. AA

Tuna

1813

Banga (JR), Alonso (AA), Gallardo (JM) and Perez (M-RI). **Mathematical modelling and simulation of the thermal processing of anisotropic and non-homogeneous conduction-heated canned foods: application to canned tuna.** *Journal of Food Engineering* 18(4); 1993; 369-387

Thermal processing of conduction-heated canned foods was modelled using 3 approaches: homogeneous isotropic; homogeneous anisotropic; and non-homogeneous anisotropic systems. Based on these models, numerical simulations were performed, using finite differences and finite elements methods. Simulation results were validated with experimental data obtained from the sterilization of canned tuna, a rather complex system. The last approach was found to be the most appropriate though the 2nd can be used for practical purposes. AA

PROTEIN FOODS

Nil

ALCOHOLIC AND NON-ALCOHOLIC BEVERAGES

Alcoholic beverages

Beer

1814

Boboye (BE) and Adetuyi (FC). **Fungal population associated with raw materials and intermediate products of lager beer produced from Nigerian sorghum grains.** *Journal of Food Science and Technology (India)* 31(2); 1994; 148-150

Fungi were enumerated on potato dextrose agar, malt extract agar, Czapek Dox and wort agar during the processing of sorghum for the production of lager beer. Isolates were purified and characterized. *Aspergillus* sp., *Rhizopus* sp., *Mucor* sp. and *Alternaria* sp dominated the populations on malt extract agar, while *Penicillium* sp, *Curvularia* sp. *Dreschlera* sp. and *Neurospora* sp formed the rest of the populations. AA

Wines

1815

Zamorani (A), Spettoli (P), Lante (A), Crapisi (A) and Pasini (G). **Immobilized laccase and tyrosinase: an approach for wine stabilization.** *Italian Journal of Food Science* 5(4); 1993; 409-414

Laccase [from *Pyricularia oryzae* and *Botrytis cinerea*] and tyrosinase [from mushroom] were immobilized by physical and chemical methods on inorganic and organic carriers [as part of a study investigating wine stabilization. Oxidative properties of immobilized enzymes in comparison with free enzymes on phenolics were also tested in model solutions of wines and musts.]. Laccase, adsorbed on molecular sieves and silica gel, and tyrosinase, immobilized both by adsorption and by covalent coupling, gave immobilization yields greater than 90%, whereas the best activity yields ranged from 22 to 38%. Laccase and tyrosinase immobilized on silica gel plus glutaraldehyde caused a decrease in the amount of catechin in model solutions of must and wine. AA

1816

Romero (LI), Nebot (E), de la Ossa (ME) and Sales (D). **Microbiological purification kinetics of wine-distillery wastewaters.** *Journal of Chemical Technology and Biotechnology* 58(2); 1993; 141-149

Wine alcohol distilleries produce 8 vol. of high-strength effluents (known as vinasse) for every vol. of ethanol. The waste has an acidic character and a high organic content. 3 microbiological bioremediation treatments (aerobic, mesophilic anaerobic and thermophilic anaerobic) for the purification of vinasses were examined. Optimum operating conditions were attained when around 90% biodegradable chemical oxygen demand (COD)

removals were achieved in every treatment. This requirement resulted in an optimum hydraulic retention time (HRT) of 8 days for aerobic, 6 days for mesophilic anaerobic and 4 days for thermophilic anaerobic processes. Experimental results were compared with those obtained from a substrate utilization kinetic model. The model accurately predicted the performance of these processes, except at HRT shorter than min., since these systems work under transient conditions. A comparison between kinetic coeff. obtained from the model showed that a thermophilic anaerobic process was the most efficient, since the process reached the same purification level, could be energy self-maintaining and needed smaller process plants than the other 2 systems. AA

Non-alcoholic beverages

Fruit juices

Apple juices

1817

Bayindirli (L), Oeziigen (M) and Ungan (S). **Mathematical analysis of freeze concentration of apple juice.** *Journal of Food Engineering* 19(1); 1993; 95-107

Apple juice concentrate was produced by freeze concn. A double-strength juice was produced in a single-stage process, whereas with a multi-stage process higher concn. levels were achieved. Lowering the refrigeration temp. shortened the time required to achieve a certain concn. level. To account for the distribution of the apple juice solids between the juice and ice, a distribution coeff. was found. A sigmoidal curve was fitted which described the freeze concn. process and which simulated the experimental data with correlation coeff. of approx. 0.99. AA

Cherry juices

1818

Sahin (S) and Bayindirli (L). **The effect of depectinization and clarification on the filtration of sour cherry juice.** *Journal of Food Engineering* 19(3); 1993; 237-245

Effects of depectinization and clarification on filtration resistance and rate of sour cherry (*Prunus cerasus*, a local var. [Afyon, Turkey]) juice were evaluated. Filtration studies on raw juice, depectinized juice and depectinized plus clarified juice were compared. Pretreatments reduced resistance considerably. Effects of the amount of precoating and the filter medium type on filtration rate were also studied. Decreasing the amount of precoating increased the filtration rate. Fabric filter medium had a lower resistance than commercial asbestos filter pads. BV

Orange juices

1819

Maccarone (E), Nicolosi Asmundo (-C), Cataldi Lupo (-MC), Campisi (S) and Fallico (B). **Oranwine. A new wine cooler with blood orange juice.** *Italian Journal of Food Science* 5(4); 1993; 397-408

A study on the preparation of 2 new low alcohol wine coolers from a common red table wine and blood orange juice, mixed in the ratios of 50/50 and 75/25 (v/v), is described. CO_2 was added after clarification. Effect of microwave treatment and storage at 4 and 20°C for up to 7 months was investigated. The products were characterized by evaluation of aroma components (terpenes and esters), colour and sensory analysis. Storage temp. played a more important role than microwave treatment on quality of the products. Comparison of sensory qualities and colour showed that the best wine cooler was the 50/50 untreated one stored at 4°C. It maintained freshness characteristics for up to 7 months of storage, while the other wine coolers had a shelf life of 3-5 months. AA

Tea

1820

Shi (Q-Z), Fouda (AE) and Matsuura (T). **Reverse osmosis transport and module analysis for green tea juice concentration.** *Journal of Food Process Engineering* 16(1); 1993; 1-20

Reverse osmosis experiments were performed to concentrate green tea juice, and experimental data analysed by using a set of

transport equations together with osmotic pressure and density data for the green tea juice. Transport parameters obtained numerically by the above analytical procedure were then used to calculate several dimensionless quantities that can characterize a reverse osmosis module. An example of module design calculation was attempted using the dimensionless parameters obtained. It was found that an increase in operating pressure reduces the module length significantly when the feed tea juice concn. is high. An increase of the mass transfer coeff. on the high pressure side of the membrane has the same effect. AA

FATS AND OILS

1821

Yurawecz (MP), Molina (AA), Mossoba (M) and Yuoh (Ku). **Estimation of conjugated octadecatrienes in edible fats and oils.** *Journal of the American Oil Chemists' Society* 70(11); 1993; 1093-1099

Some isomers of conjugated octadecadienoic acid show anticarcinogenic and antioxidant properties. 27 vegetable oils (including corn, soya, rice bran, oat bran, cottonseed, safflower) and beef and bacon fats were studied, using UV spectroscopy, to determine the quantities of conjugated octadecatrienes (COT) present. COT levels ranged from < 0.001 to 0.2%. Using GC, COT levels estimated were lower (< 0.001-0.051%). Reduced peroxides of oleic and linoleic acid moieties were converted to conjugated dienes and trienes when methylated with boron trifluoride. Levels of COT which may cause health concerns or have anticarcinogenic activity are not presently known. BV

1822

Dobson (KS), Williams (KD) and Boriack (CJ). **The preparation of polyglycerol esters suitable as low-caloric fat substitutes.** *Journal of the American Oil Chemists' Society* 70(11); 1993; 1089-1092

Manufacture of polyglycerol esters (PG) suitable as low calorie fat substitutes is discussed. Linear polyglycerols (LPG) were prepared by a propriety polymerization process. PG oils were prepared by mixing LPG with pyridine; addition of oleoyl chloride, at temp. less than 70°C, and hexane to disperse reactants; filtering through glass wool; concentration by rotary evaporation; steam stripping; saturation with ethanol; and extraction with additional ethanol to obtain a level of less than 0.1% free fatty acid. Resulting PG oils were poorly absorbed by animals and fatty acid esters resisted hydrolysis by digestive enzymes. Results indicated that LPG esters had colour, odour, taste and physical properties similar to natural triglycerides; and that LPG oils may be suitable for use in non-nutritive edible oil applications, particularly those requiring stability at high temp. BV

1823

Roy (SS) and Bhattacharyya (DK). **Detection of interesterified fat in hydrogenated fat by lipase hydrolysis and by cooling curve analysis.** *Journal of the American Oil Chemists' Society* 70(9); 1993; 923-925

Porcine pancreatic lipase hydrolysis and Jensen's cooling curve (JCC) methods were used to detect interesterified fat (IF) products in a mixture with hydrogenated fats (HFs). Lipolysis of IFs showed a greater amount of saturated fatty acids in the 2-monoglycerides in comparison with HFs. A similar trend in the distribution pattern of fatty acids was also noted in a mixture. IFs did not show any rise in temp. in JCC experiment, whereas HFs showed a distinct increase. A gradual increase in temp. was obtained for an IF when it was mixed with increasing content of a HF. HF showed a reduced temp. increase when it was mixed with an IF. Simultaneous detn. of the fatty acid profiles of the 2-monoglycerides and JCC characteristics can be used to detect the occurrence of one modified fat in another. BV

1824

Murali (HS), Mohan (MS), Manja (KS) and Sankaran (R). **Polar and nonpolar lipids and their fatty acid composition of a few *Fusarium* species.** *Journal of the American Oil Chemists' Society* 70(10); 1993; 1039-1041

Fusarium spp. (*F. lini* ITCC 788, *F. lycopersici* ITCC 1322, *F. oxysporum* ITCC 1635, *F.*

equeseti, *F. moniliforme* and *F. pallidoroseum*] were evaluated for their potential to produce lipids. Isolates exhibited wide variation with respect to the mycelial wt., total lipid content and % composition of polar (PL) and nonpolar lipids (NPL). Triglycerides were the major components (81-90%). Palmitic, stearic, oleic (OA) and linoleic acids (LA) were the major fatty acids in PL and NPL. PL contained higher levels of LA, whereas NPL contained OA as the predominant acid. NPL were more saturated than polar lipids. BV

1825

Suutari (M), Priha (P) and Laakso (S). **Temperature shifts in regulation of lipids accumulated by *Lipomyces starkeyi*.** *Journal of the American Oil Chemists' Society* 70(9); 1993; 891-894

Effect of temp. on triglycerides by *Lipomyces starkeyi* was studied in 10-l fermentation experiments. The temp. during growth, lipid accumulation and post-accumulation phases was altered. The cellular lipid content, the glucose conversion efficiency and the specific lipid production rate were highest when the growth phase temp. was 28°C, instead of 16-18°C. The temp. of the accumulation phase had an influence on the lipid quality at the end of the accumulation. Oleic acid content increased from 52 to > 60% when the accumulation phase temp. was decreased from 28 to 15°C and, concomitantly, palmitic acid decreased from 33 to 26%. The degree of fatty acid unsaturation was highest (0.75 Δmol^{-1}) when the accumulation phase temp. was the lowest (15°C) and vice versa. The temp. shift after the lipid accumulation phase affected neither the composition nor the amount of accumulated lipids. Study indicates the temp. profile for the highest lipid yield with the most desired composition should be: (a) a growth phase temp. that gives the max. growth rate; and (b) an accumulation phase temp. that produces the desired ratio of palmitic to oleic acid. BV

Oils

1826

Chandrasekharan (CV) and Basu (AK). **Lipase catalysed hydrolysis of oils in microemulsion medium.** *Journal of the Oil Technologists Association of India* 26(2); 1994; 53-58

Low temp. hydrolysis of sunflower, rapeseed, groundnut, neem and karanja oils using SP 398, a liquid lipase derived from certain microorganism by fermentation, was studied at 40 plus or minus 2°C along with 30% water on the wt. of oils. Results indicated that lipase Sp. 398 was effective in all vegetable oils. Even after 16 h, the degree of hydrolysis ranged between 66.6 and 72.4%. GS

1827

Irandoust (S) and Edvardsson (J). **Poisoning of nickel-based catalysts in fat hydrogenation.** *Journal of the American Oil Chemists' Society* 70(11); 1993; 1149-1156

Discusses the poisoning of Ni-based catalysts in fat hydrogenation (FH) with reference to deactivation of hydrogenation of vegetable and fish oils; the poisoning effect of S and its role on the reactant adsorption in different hydrogenation reactions; factors affecting S resistance of the catalyst metal; and other inhibitors influencing FH (P compounds, free fatty acids, sodium soaps, chlorophyll, halogen compounds and products of lipid oxidation). BV

1828

Vazquez (TJF) and Guerrero. I. R.. **Regressional models that describe oil absolute viscosity.** *Journal of the American Oil Chemists' Society* 70(11); 1993; 1115-1119

Equations and correlation constants were obtained which describe the temp. dependent variation of the absolute viscosity μ) of 21 oils (sunflower, corn, rapeseed, sesame) and oil-liquid fat (melted butter) mixtures. Regression analyses were based on 2 approaches: (I) fitting the oil and oil-fat mixture viscosity profiles to a quadratic extension of the Andrade equation; and (II) multiple variable regressional modelling. (I) provided the best predictive models (R^2 > 0.96), but the coeff. associated with temp. effect had no physical-chemical meaning. The multiple regressional approach (II) fitted, in 1 equation, the μ of all 21 oil systems (r^2 equivalent to 0.93).

This equation included parameters such as saponification value and iodine value of the fatty acids of acylglycerols. Regressional models described effects of the cis double bonds and fatty acid chain length on interactions of acylglycerols which determine μ of the system and its capability to crystallize. Thus Multiple variable regressional analysis forms an excellent tool for better understanding the quantitative structure-functional property relationships in lipid systems. BV

1829

Blomberg (LG), Demirbueker (M) and Andersson (PE). **Argentation supercritical fluid chromatography for quantitative analysis of triacylglycerols.** *Journal of the American Oil Chemists' Society* 70(10); 1993; 939-946

Reports a method for quantitative analysis of neutral lipids. 4 different techniques were combined (supercritical fluid chromatography (SFC), silver ion chromatography, packed micro-columns and miniaturized evaporative light-scattering detection (ELSD)). Development and optimization of the method are discussed. Separation of a series of vegetable, fish and hydrogenated oils was demonstrated. Application of eluent composition programming resulted in excellent separation of complex samples. Packed microcolumn argentation SFC provides at least as high a separation power as corresponding HPLC methods. The combination of packed microcolumn SFC and miniaturized ELSD constitutes a powerful analytical system for the quantitative analysis of triacylglycerols. BV

Butter oils

1830

Sunfeld (E),Krochta (JM) and Richardson (T). **Separation of cholesterol from butteroil using quillaja saponins. II. Effects of temperature, agitation and concentration of quillaja solution.** *Journal of Food Process Engineering* 16(3); 1993; 207-226

Separation of cholesterol from butter oil was achieved by various processes based on contacting it with aqueous solutions of Quillaja saponaria saponins followed by separation of the cholesterol-saponin complex. 5 processes and controls were carried out as described in part I, namely: (i) Water Control (W); (ii) Reaction (R); (iii) Adsorption Control (A); (iv) Reaction + Adsorption (R + A); (v) Reaction + Washing (R + W). Analysis of variance models (ANOVA) indicated that the Adsorption Control process did not yield any significant cholesterol reduction over the Water Control; all other processes resulted in significant cholesterol separation in the order R + A greater than R + W greater than R. Levels of cholesterol reduction achieved by the R, R + W, and R + A processes were significantly affected by concn. of quillaja solution and temp. (0.04 or 0.40 mg/ml and 45, 55 or 65°C, respectively); level of agitation (high, medium or low) had no significant effect. Quillaja powder residue was present in the fat phase after Reaction (ii) but both adsorption and washing procedures significantly reduced it. AA

1831

Sundfeld (E), Yun (S), Krochta (JM) and Richardson (T). **Separation of cholesterol from butteroil using quillaja saponins. I. Effects of pH, contact time and adsorbent.** *Journal of Food Process Engineering* 16(3); 1993; 191-205

The technical feasibility of separating cholesterol from butter oil by contacting it with aqueous solutions of Quillaja saponaria saponins followed by separation of the cholesterol-saponin complex was studied. Alternative processes and controls compared were: (i) Water Control (W), where butter oil was contacted with pure water; (ii) Reaction (R), where butter oil was contacted with aqueous solution of saponins; (iii) Adsorption Control (A), where butter oil was contacted with water and diatomaceous earth was then added; (iv) Reaction + Adsorption (R + A), where diatomaceous earth was added to the Reaction medium (from ii); and (v) Reaction + Washing (R + W), where the aqueous phase resulting from Reaction (ii) was discarded and pure water contacted with the fat. The last step in all 5 processes was the separation of the fat phase where cholesterol was determined. Statistical analysis [using analysis of variance (ANOVA) models] indicated that the Adsorption Control did not yield any significant cholesterol reduction over the Water Control, while all

other processes gave significant reduction. Order of cholesterol separation observed was R + A greater than R + W greater than R. Levels of cholesterol reduction were significantly affected by pH of quillaja solution [4.5 or 7.0] and amount of adsorbent used [0.05 or 0.25 g/g butter oil]; time of contact with quillaja solution had no significant effect over the range investigated [30 or 60 min]. Results indicate the technical feasibility of reducing cholesterol levels of butter oil using food grade quillaja saponins. AA

Olive oils

1832

Mannino (S), Cosio (MS) and Bertuccioli (M). **High performance liquid chromatography of phenolic compounds in virgin olive oils using amperometric detection.** *Italian Journal of Food Science* 5(4); 1993; 363-370

A simple and reproducible method for the quantitative determination of phenolic compounds in virgin olive oils was developed. Following solid phase extraction with a C18 Bond Elut cartridge and reversed-phase HPLC, these compounds were detected amperometrically using a dual electrode detector in the parallel configuration operating at +0.5 and 1.0 V vs. Ag/AgCl. Virgin olive oils of different origin and cv. and obtained using various techniques were analysed. Consistent recoveries of greater than 95% were achieved from spiked samples and the detection limit was in the order of 2 p.p.b. The method is easy to perform and can be used for large scale routine analysis. AA

1833

Montedoro (GF), Begliomini (AL), Servili (M), Petruccioli (M) and Federici (F). **Pectinase production from olive vegetation waters and its use in the mechanical olive oil extraction process to increase oil yield and improve quality.** *Italian Journal of Food Science* 5(4); 1993; 355-362

A multi-phase disposal process for olive vegetation waters (OVW), which result from the mechanical extraction of olive oil, was studied in relation to 2 main phases of the technological process: biological treatment of OVW to obtain an enzymic concentrate and direct recycling of this concentrate in the mechanical olive oil extraction process. The disposal treatment for OVW includes static settling, sterilization, fermentation, centrifugation (in which biomass is recovered and used as an animal feed) and ultrafiltration (resulting in a permeate that is discarded and an enzymic retentate conc.). The enzymic retentate conc. is recycled and used in the malaxation step in the mechanical olive oil extraction process. The fermentation step with the yeast *Cryptococcus albidus* var. albidus IMAT 4735 led to production of a polygalacturonase with an activity of 25 VU/ml in the culture broth. After centrifugation, the broth was concentrated by ultrafiltration (4-5x) and used in the extraction process. This op eration resulted in an increase of 8-9% in olive oil yield and improved oil quality; turbidity, oxidation induction time, chlorophyll and contents of aromatic compounds were generally improved. AA

1834

Hamdi (M) and Garcia (JL). **Anaerobic digestion of olive mill wastewaters after detoxification by prior culture of *Aspergillus niger*.** *Process Biochemistry* 28(3); 1993; 155-159

Rapeseed oils

1835

Leger (LW) and Arntfield (SD). **Thermal gelation of the 12S canola globulin.** *Journal of the American Oil Chemists' Society* 70(9); 1993; 853-861

The nature of intermolecular forces responsible for thermal gelation of the 12S canola [rapeseed] globulin was determined by preparing gels under a variety of environmental influences. Effects of pH, Na salts and denaturing agents were evaluated by DSC, small amplitude oscillatory rheology and transmission light microscopy. Gels prepared with 6% protein at alkaline pH values were superior to gels prepared under acidic conditions. Na salts, which promoted protein stability, had an adverse effect on gelation. Addition of guanidine hydrochloride and dithiothreitol to protein dispersions prior to heating produced inferior gels. Hydrophobic

forces and electrostatic interactions were responsible for the establishment of canola gel networks. Gel stabilization and strengthening were attributed to disulphide bonding, electrostatic interactions and H bonding. AA

SPICES AND CONDIMENTS

Spices

Tamarind

1836

Bhattacharya (S), Bal (S), Mukherjee (RK) and Bhattacharya (S). **Some physical and engineering properties of tamarind (Tamarindus indica) seed.** *Journal of Food Engineering* 18(1); 1993; 77-89

The chemical composition of tamarind (*Tamarindus indica*) seeds and kernels, as well as some industrially important physical and engineering properties, were determined. The kernel powder was rich in potassium. The shape of the whole tamarind seed did not conform to any of the standard shapes of seeds. The length, breadth, thickness, sphericity, roundness, surface area, average wt. and vol. per seed were also determined. The bulk density of raw, whole seed was slightly greater than that of roasted kernels. The surface area of seeds was linearly related to wt. per seed (r greater than or equal to 0.96, P less than or equal to 0.01). The angle of friction of whole seed was determined on rough, smooth, and very smooth surfaces. The angle of repose for roasted kernel (34-39°C) was higher than that of the raw whole seeds (31-35°C). AA

SENSORY EVALUATION

1837

Ofoli (RY) and Steffe (JF). **Some observations on the use of slit rheometry for characterizing the primary normal stress difference of extrudates.** *Journal of Food Engineering* 18(2); 1993; 145-157

Experimental evidence is presented to demonstrate that the standard procedure of linearly extrapolating pressure profiles through the exit of slit rheometers as a means of characterizing extrudate elastic properties is inappropriate. This widely used procedure, based on the assumption that the pressure gradient is constant over the entire instrument, is erroneous because the flow does not remain fully developed through the exit of the rheometer. AA

1838

Konik (CM), Miskelly (DM) and Gras (PW). **Starch swelling power, grain hardness and protein: relationship to sensory properties of Japanese noodles.** *Starch/Staerke* 45(4); 1993; 139-144

Relationships between starch swelling power (SSP) and Japanese noodle eating quality were examined for a range of commercial Australian wheat cv. from 2 growing seasons. SSP was dependent on cv., growing site and growing season of wheat. Analyses of the 1st season's samples showed highly significant relationships between swelling power and most noodle quality parameters (r^2 = 0.16-0.45, P < 0.01). Inclusion of wheat protein and wheat softness (PSI) with SSP in multiple regression equations provided improved relationships to most noodle quality parameters (r^2 = 0.25-0.62, P < 0.01). When tested on data from the 2nd growing season, predictions were useful, especially for the noodle parameters elasticity and eating quality. BV

FOOD STORAGE

Nil

INFESTATION CONTROL AND PESTICIDES

Nil

BIOCHEMISTRY AND NUTRITION

1839

Siddiqui (SF), Pasha (MK), Ahmad (F) and Ahmad (M). **Digestibility of some**

non-conventional seed proteins. *Journal of the Oil Technologists Association of India* 26(2); 1994; 49-51

Pepsin digestibilities of 10 seed proteins, viz. *Hibiscus esculentus* (I), *Punica granatum (II)*, Boerhaavia retusa *(III)*, Cleome viscosa *(IV)*, Bauhinea purpurea *(V)*, Arachis hypogea *(VI)*, Santalum album *(VII)*, *Soybean (VIII)*, Cassia absus *(IX)* and Mucuna pruriens *(X)*, were determined in vitro by Lowry's method. Soybean proteins have higher digestibility value compared to Arachis hypogea. Digestibility of V, VII and X seed proteins is higher than soybean proteins. Seed proteins of I, II and III show higher digestibility compared to A. hypogea and lower digestibility values compared to soyabean. AA

1840

Dahiya (S) and Kapoor (AC). ***In vitro* and *in vivo* availability of iron from home processed supplementary foods.** *Journal of Food Science and Technology (India)* 31(2); 1994; 122-125

Four supplements, containing 16.47 plus or minus 0.48 to 17.67 plus or minus 0.55 mg Fe/100 g and consisting of whole wheat, pearl millet, Bengalgram, greengram, groundnuts, amaranth leaves (*Amaranthus gangeticus*) and jaggery, were developed, employing home processing methods of roasting and malting. Domestic processing increased the *in vitro* Fe availability, due to lower levels of anti-nutrients. Pearl millet (*Bajra*)-based supplemented groups (III and IV) of rats showed significantly ($P < 0.05$) higher haemoglobin levels in blood than those fed wheat-based supplements (I and II) and similar levels to those of group fed on commercial food. The apparent absorption, balance and retention of Fe in rats fed on pearl millet supplements was also significantly higher than those of wheat-based ones and commercial product fed group. The data showed that home processed supplement mixes of cereals, pulses, nuts and leafy vegetables being good sources of Fe could improve Fe status of young children of low income groups. AA

1841

Farr (D). **Amino acids and flavour fermentations for use in foods.** *Journal of Chemical Technology and Biotechnology* 58(2); 1993; 201-203

Discusses the possible lessons to be learned by flavour technologists from a consideration of traditional Japanese fermentations for flavour compounds and seasonings. Fermentations included are soy sauce, miso and mirin. Fermented seasonings that could be incorporated into Western-style products by combining the koji fermentation with novel protein sources such as meat (animal or fish) or peanuts is suggested. BV

1842

Nabbut (NH). **The *Salmonella* problem in Lebanon and its role in acute gastroenteritis.** *Journal of Food Protection* 56 (3); 1993; 270-272

TOXICOLOGY

1843

Shantha (T). **Methods for estimation of aflatoxins. A critical appraisal.** *Journal of Food Science and Technology (India)* 31(2); 1994; 91-103

The review deals with advantages and limitations of most sophisticated and old methods so as to facilitate selection of most dependable and practical ones by the analysis of the developing countries. Aspects considered in this review are: importance of analytical methods, principles of estimation, steps in methodology, detection and estimation methods and overviews. 101 references. SD

1844

Brady (MS), White (N) and Katz (SE). **Resistance development potential of antibiotic/antimicrobial residue levels designated as 'safe levels'.** *Journal of Food Protection* 56(3); 1993; 229-233

Potential for 'safe levels' of antibiotics/antimicrobial residues (as defined by the FDA) to select for resistance in Staphylococcus aureus ATCC 9144, a sensitive bacterium, was investigated. S. aureus was exposed to safe levels of ampicillin,

dihydrostreptomycin, erythromycin, neomycin, oxytetracycline and sulphamethazine, singly or in combinations of 3, for 14 days, transferring to fresh medium daily. After 14 days, min. inhibitory concn. (MIC) were determined. In control, 1.23% of samples showed an increased MIC. With exposure to single antibiotics, 7.40% of samples had increased MIC. When combinations of 3 antibiotics were used, 33.95% of samples showed increased MIC; this represents 27.6x the incidence of MIC increase seen in controls and 4.6x the incidence of increase seen with single antibiotics. Since food samples, such as milk, are bulked before distribution, there is potential for them to contain a variety of antibiotics. Data indicate that safe levels of antibiotics, that may be present in milk, have a strong potential for selecting resistant bacterial populations. AA

FOOD LAWS AND REGULATIONS

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